OCTOBER 2000 AND AUGUST 2002
SURVEY OF SEDIMENT CONTAMINATION IN THE CHICAGO RIVER, CHICAGO, ILLINOIS

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EXECUTIVE SUMMARY

In October 2000, the U.S. Environmental Protection Agency's Great Lakes National Program Office (GLNPO) and the U.S. Army Corps of Engineers (USACE) coordinated a baseline screening study to provide a broad view of sediment conditions throughout the Chicago River system, specifically the North and South Branch, while targeting depositional zones within the river. Using GLNPO's sediment sampling vessel, the *Research Vessel (RV) Mudpuppy*, GLNPO and USACE collected a total of six (6) surficial ponar grabs and twelve (12) sediment cores from twelve (12) locations in the area of the river beginning north from the Webster Street bridge continuing south to 32nd Street and including the Ship and Sanitary Canal. Sediment and ponar samples were analyzed for total organic carbon (TOC), oil and grease, dioxins and furans, heavy metals, polychlorinated biphenyl (PCBs), polycyclic aromatic hydrocarbons (PAHs), volatile organics, and pesticides. Additionally, sediment ponar samples were subjected to 28-day *Hyalella azteca* and 10-day *Chironomus tentans* whole sediment toxicity tests, as well as simultaneously extracted metals/acid volatile sulfide (SEM/AVS) tests.

Results of this study found significantly elevated levels of PAHs in most samples that were analyzed, up to 716 parts per million (ppm) in one sediment sample in the South Branch of the river. PAH concentrations tend to be higher in the deepest section of the sediment cores (> 54 inches) in the South Branch of the river, while samples collected in the North Branch indicate significantly lower PAH concentrations in both the ponar and cores samples. Samples analyzed for oil and grease show extremely elevated concentrations throughout the entire river system, with contamination increasing in the deeper sediments (>50,000 ppm in one sample). Heavy metals, including lead, cadmium, chromium, nickel, copper, zinc and mercury also indicate high levels of contamination throughout the entire sampling area, but based upon SEM/AVS analysis, it does not appear that these metals are bioavailable in the surficial sediments at most sampling locations. Finally, PCB results show elevated levels (up to 76 ppm in one location) in the deeper sediments in the North Branch of the river, with elevated levels also present in the South Branch (1 to 10 ppm). These results are consistent with previous sampling events in this area of the Chicago River, but most of the previous studies have been limited to chemical analysis of short sediment cores of minimal length and surficial ponar grabs. For this study much longer cores were collected to determine the vertical extent of contamination, and this data indicates that contamination significantly increases with depth in the Chicago River system.

Results of the 2000 toxicity tests indicate that neither *H. azteca* nor *C. tentans* were significantly impacted for mortality (organism survival), except at one sampling location in the North Avenue turning basin, ChR00-02, for *H. azteca*. However, this sample had extremely low dissolved oxygen levels observed for one replicate, for two consecutive days, during the testing and should be considered subjective. The measurement of growth for *H. azteca* also showed no significant difference when compared to the control group. Results from the 10-day *C. tentans* toxicity growth tests were not evaluated due to a lab error during the completion of the dry weight/ash free dry weight data. Additional samples were collected in August of 2002 and analyzed for whole sediment toxicity tests and results indicated that several samples had reduced survival and growth for both *H. azteca* and *C. tentans*. However, QA/QC concerns regarding the 2002 *C. tentans* toxicity samples relegate their use to qualitative purposes only. *H. azteca* results indicated that all samples were statistically significant compared to the control for the growth endpoint, and that three out of the five samples showed reduced survival.

A QA/QC review of the data indicates that most of the chemical and toxicity data are of good quality. However, as indicated above, 10-day *C. tentans* toxicity tests for growth were not evaluated in this report due to laboratory error. Also, the results for total petroleum hydrocarbon (TPH) should be considered unusable due to lab error. Finally, one sample analyzed for oil and grease (ChR00-05-A) had results that were extremely high (1,530,000 mg/kg) and were not used in this report.

Based upon the results of the data the following conclusions are made:

- PAH concentrations, especially in the South Branch of the river are elevated and potentially present an ecological and/or human health threat;
- PAHs, oil and grease, dioxins and furans and PCBs are the primary contaminants of concern, with metals a secondary contaminant of concern, identified in the sediments throughout the Chicago River system;
- Heavy metals including cadmium, copper, chromium, lead and zinc all have high levels of contamination, but based upon SEM/AVS analysis during this survey these metals were not bioavailable to the benthic community in the surficial sediment except in locations on the South Branch of the river. Additional SEM/AVS analyses should be performed for any future sampling that is planned to ensure that metals, in fact, are not bioavailable;
- Sediments in the Main Branch, near Lakeshore Drive, are significantly less contaminated than other portions of the river;
- PCB contamination appears to be higher in the deeper sediments in the North Branch of the river than in the sediments of the South Branch; and
- Overall, the surficial sediments are less contaminated than the deeper sediments throughout the river system for the primary and secondary contaminants of concern.

Based upon these conclusions, the following recommendations are made for this area of the Chicago River:

- Collect additional samples at ChR00-05 to determine if the extremely elevated concentration for oil and grease in the surficial sediments are accurate;
- Collect additional samples at ChR00-11 and ChR00-12 and section the samples according to how they were sectioned for this study (0-6 in., 6-18 in., 18-54 in., > 54 in.) to determine the vertical extent of contamination for PAHs, oil and grease, and metals in each section;
- Perform a benthic community assessment to more fully understand if the elevated chemistry levels are affecting the benthic community in the Chicago River system;
- Perform bioaccumulation studies in the North Branch to determine potential uptake of PCBs;
- Collect additional samples along the entire study area for toxicity testing and analyze using 10-day *Chironomus tentans* and 28-day *Hyalella azteca*; and; and
- Incorporate and evaluate other existing data sets to more fully understand the extent of contamination on the Chicago River.

1. BACKGROUND

Located in the northeast portion of Illinois, the Chicago River System incorporates 156 river miles including the Chicago River, the North Shore Channel, the Sanitary and Ship Canal, and the Calumet-Sag Channel. The river's northernmost headwaters are in Lake County, near Park City, IL. The Chicago River has three northern branches; the West Fork, the Middle Fork, and the East Fork (a.k.a the Skokie River), that basically flow south, parallel to each other, until the Middle Fork joins the East Fork, and then the West Fork joins that new combination, sometimes called the "Upper North Branch." The three branches meet in Chicago's near north suburbs, around Morton Grove, IL and are surrounded by the Cook County Forest Preserve.

The North Branch (now one stream) continues to flow south and east through the Chicago’s Northwest side where it joins the North Shore Channel. The North Shore Channel is a completely manmade waterway that pulls water from Lake Michigan at Wilmette Harbor. The larger, wider combined streams, still called the North Branch, flows south through the city's north side, just west of Western Avenue. The river continues south and east until it reaches Kinzie Street (about 400 North) where it meets up with the Main Branch, which flows due west through downtown Chicago, past the Wrigley Building, IBM Plaza, and the Merchandise Mart.

These two branches join together, become the South Branch of the river, and flow south through the city until they meet up with the Sanitary and Ship Canal near the intersection of Ashland and Archer. An offshoot of the South Branch, called Bubbly Creek, flows north into the Sanitary and Ship Canal. The Sanitary and Ship Canal flows southwest out of Chicago until it meets with the Des Plaines River near Lockport, Illinois.

The deepest portion of the river is in the Main Branch, where water depth is currently approximately 20-21 feet. Prior to human intervention, this portion of the river was much a much shallower depth, approximately two (2) feet. The widest point on the river is the North Avenue Turning Basin, where it is approximately 800 feet wide. Portions of the river contain soft sediments deposits over 30-feet in depth.

Prior to human intervention the Chicago River drainage area was a low, flat, and swampy. The river was historically slow moving with shallow banks. In 1900 the river's flow was reversed in order to solve a drinking water contamination problem that killed over 80,000 Chicagoans in the 1880's. The Chicago Sanitary District built the Sanitary and Ship Canal to connect the Chicago River to the Des Plaines and Illinois Rivers. The portion of the River that flows through downtown Chicago -- the Main Branch -- and the South Branch (except for Bubbly Creek) were reversed so that's the river now flows away from Lake Michigan.

2. HISTORICAL SEDIMENT SURVEYS

The USACE previously conducted studies in the 1980s on all three branches of the Chicago River. These studies indicated elevated concentrations of semivolatile organic carbons (SVOCs), PCBs, and total petroleum hydrocarbons (TPH) in sediments throughout each of the three branches. The highest reported PCB concentration was 96 ppm from a sample collected in the North Branch. The Metropolitan Water Reclamation District of Greater Chicago (MWRD) also collected samples along the river in June 1992. Results showed high levels of total metals and chemical oxygen demand (COD).

3. SAMPLING ACTIVITY

In October 2000, sediment core samples were collected from twelve (12) locations with a viborcorer sampling device, which uses a long, raw-edged fiberglass coring tube to retrieve the sediment. Two replicate cores were taken, a replicate sample being a second core taken very near the original in order to compare the two results. Four duplicate samples were prepared for the laboratory by splitting three core samples and one ponar sample and doing a separate set of analyses on each half for quality control. This survey was designed to collect and analyze sediment cores up to 90-inches long (7.5 feet). Portions of any sediment cores deeper than 90-inches were discarded.

Surficial samples from six (6) locations were collected with a ponar dredge, with one duplicate also collected. The ponar dredge collects the top 6-8 inches of sediment. Figure 1 illustrates sampling locations for core and ponar samples.

All of the core and ponar samples were analyzed for heavy metals, PCBs, pesticides, PAHs, oil and grease, mercury and total organic carbon (TOC). A subset of the core samples was also analyzed for dioxins/furans and volatile organics. Additionally, sediment ponar samples were subjected to 10-day *Chironomus tentans* (survival and growth) and 28-day *Hyalella azteca* (survival and growth) whole sediment toxicity tests and for SEM/AVS analysis. Analytical methods for each parameter are provided in Table 1.

TABLE 1. Analytical Test Methods for Chemical and Toxicity Testing

Parameter	Analytical Method
Toxicity Tests	EPA Test Methods 100.1 and 100.2
TOC	9060/Lloyd-Kahn
Oil and Grease	EPA 9071B
Dioxins and Furans	EPA 8290A
Metals Kit	EPA 6020, 6010A
Arsenic/Cadmium	6010B
Mercury	7471A
PCBs	EPA 8082B
Pesticides	8081A
Volatile Organics	EPA 8260B
PAHs	EPA 8270C
AVS	EPA 121-R91-100
SEM	EPA 6020M 6010A

The samples were collected aboard the EPA Research Vessel Mudpuppy. Sampling was performed along the North Branch of the Chicago River from the Webster Street Bridge and continuing south to the South Branch of the river near 32nd Street. One station in the Ship and Sanitary Canal was also sampled.

Sediment cores were sectioned into predetermined intervals of 0”-6”, 6”-18”, 18”-54”, and 54”-90". Cores less than 54” in length resulted in less than four sections being sampled. After sectioning, each interval was individually homogenized and placed into separate containers for shipment to the laboratory for analysis.

4. ANALYTICAL RESULTS

This summary report will focus on the results of the PAH, oil and grease, metals, dioxins/furans, and PCB analyses since the results for these chemicals were relatively high when compared to sediment quality guidelines. The sediments were analyzed for a wide range of chemicals, but the results suggest that PAHs, PCBs and oil and grease should be the primary chemicals of concern at this site, with metals as secondary chemicals of concern. This is based upon SEM/AVS analyses indicating that metals in surficial sediments do not appear to be bioavailable to the benthic community, but deeper sediments generally show elevated metals' concentrations.

The results of all analytical data for chemical analysis and toxicity testing are provided in Appendix C, "Sediment Chemistry Data", and Appendix D, "Whole Sediment Toxicity Testing Data", respectively.

4.1 SEDIMENT CHEMISTRY RESULTS

As part of a screening level review of the results of the chemical analysis, contaminant levels in the sediment samples were compared to consensus-based sediment quality guidelines (SQGs) established by MacDonald et al. (2000). SQGs are particularly useful in quickly identifying sampling locations that are potential concerns in relations to human health and ecological risk. However, SQGs are only useful as screening-level evaluations, and should be used in conjunction with a variety of other assessment and evaluation tools to fully evaluate sediment quality conditions at this site.

MacDonald et al. determined two cutoff levels for each contaminant based on their expected impact to sediment-dwelling organisms: the threshold effects concentration (TEC), which is the concentration below which the substance would not be expected to have toxic effects in the environment, and the probable effects concentration (PEC), or the concentration above which harmful effects are likely to be observed. TEC and PEC concentrations for each parameter are provided in Appendix C, along with the analytical data for each sediment sample.

Total Metals

Based upon a comparison of the data in Appendix C to the TEC and PEC values, surficial samples (0-6 inches) indicate that cadmium, chromium, copper, lead, mercury, nickel, and zinc always exceed the TEC and almost always exceed the PEC, except in Ch00-06P, where the PEC is only exceeded for lead and mercury. In the deeper sections of the core (18-54 inches and below 54 inches), analytical results show that arsenic at most locations is above the TEC and every other metal analyzed is above the PEC. The average lead concentration for the 0 – 6 inch layer is 322 ppm compared to the PEC of 128 ppm. Figure 1 illustrates how lead contamination increases with depth. Yet, since SEM/AVS analyses indicated that metals in the suficial sediments were not bioavailble, metals should be considered secondary contaminants of concern.

SEM/AVS

Surficial ponar samples were also analyzed for SEM/AVS to determine the amount of sulfide in the sediment. The amount of extractable metals and the amount of sulfide in a sample are each measured and the value of the extractable metals is then divided by the value for sulfide. If this number is greater than 1.0, then the metals are likely bioavailable to the benthic community members that ingest this sediment. Only two samples had an

SEM/AVS value greater than 1.0, ChR00-07-P and ChR00-08-P, with values of 1.2 and 1.6, respectively. This would suggest that at the other sampling locations only minimal amounts of metals would be bioavailable and cause toxicity at the locations sampled for this survey. However, studies have suggested that the measurement of AVS is often recommended during the coldest times of the year in order to show the likely lowest concentrations and thus provide an estimate of metal bioavailability in a worst case scenario. Additional surficial samples should therefore be collected and analyzed during the winter months to determine if there is a seasonal variation for the SEM/AVS results within the river system.

PCBs

Concentrations for PCBs vary from the North Branch to the South Branch of the river. PCB results in the North Branch of the river are significantly higher than in the South Branch, especially in deeper sediments. One sample collected in the North Branch (ChR00-01-C, 18"-54" interval) has a PCB concentration of 76 ppm, significantly above the TSCA level of 50 ppm. Samples in the other sections of this core are all below 22 ppm. In the South Branch of the river, PCBs are present at somewhat lower concentrations, with the highest results in the deeper cores and not exceeding 16 ppm. Out of the 48 samples analyzed for PCBs, all but three exceeded the PEC of 0.7 ppm, and those three that did not exceed the PEC exceeded the TEC value for PCBs. The average PCB concentration for the 0 – 6 inch layer is 3.8 ppm compared to the PEC of 0.676 ppm. Figure 2 summarizes the PCB results from samples collected for this assessment. Table 2 shows that 94% of the samples analyzed for PCBs exceeded the PEC and that 83% of the samples were 3 times the PEC. Based on the levels of PCBs found during this survey, PCBs should be considered a primary contaminant of concern in the Chicago River.

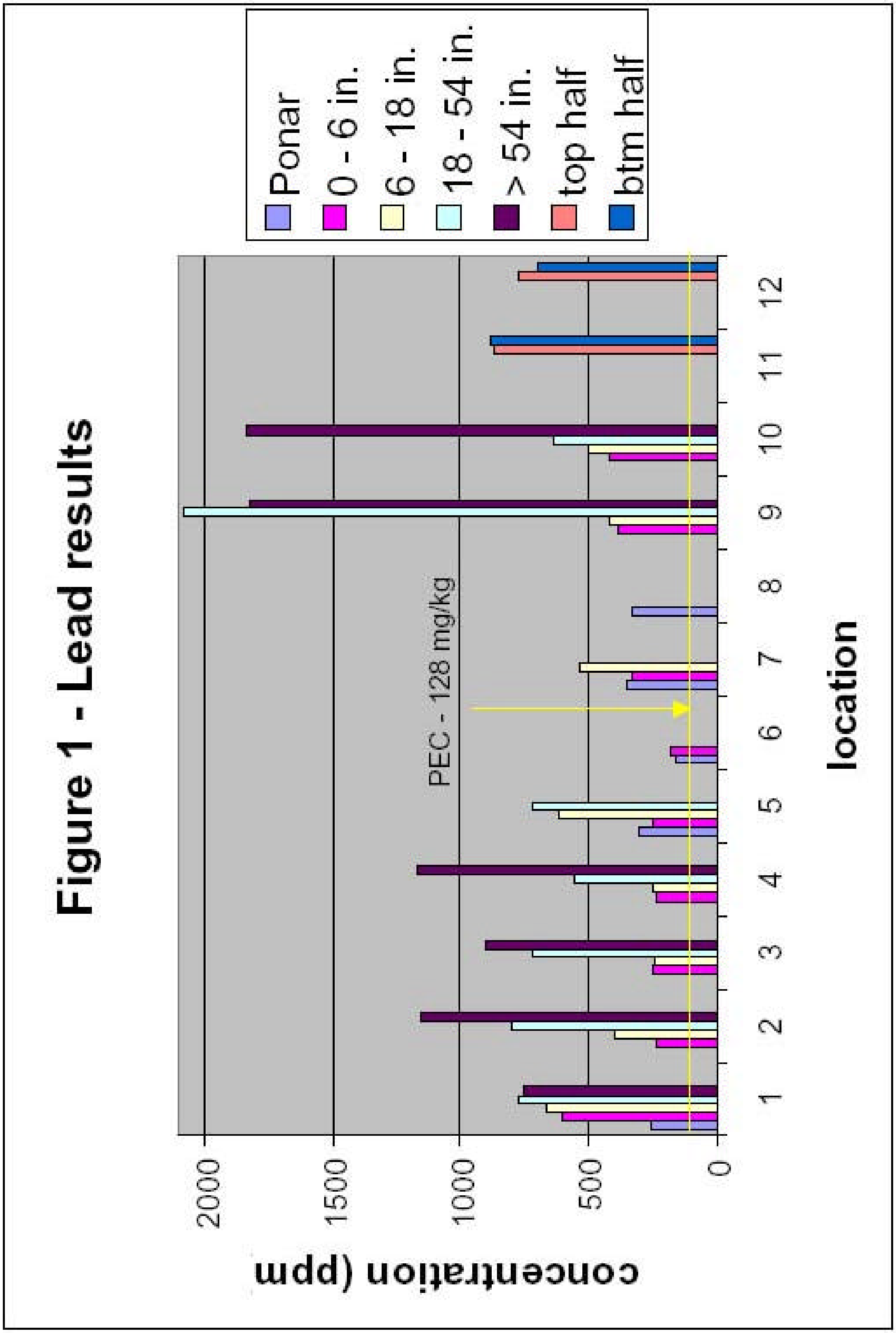
Figure 1 - Lead results
concentration (ppm
2000
1500
1000
500
0
location
1
2
3
4
5
6
7
8
9
10
11
12
PEC - 128 mg/kg
Ponar
0 - 6 in.
6 - 18 in.
18 - 54 in.
> 54 in.
top half
btm half

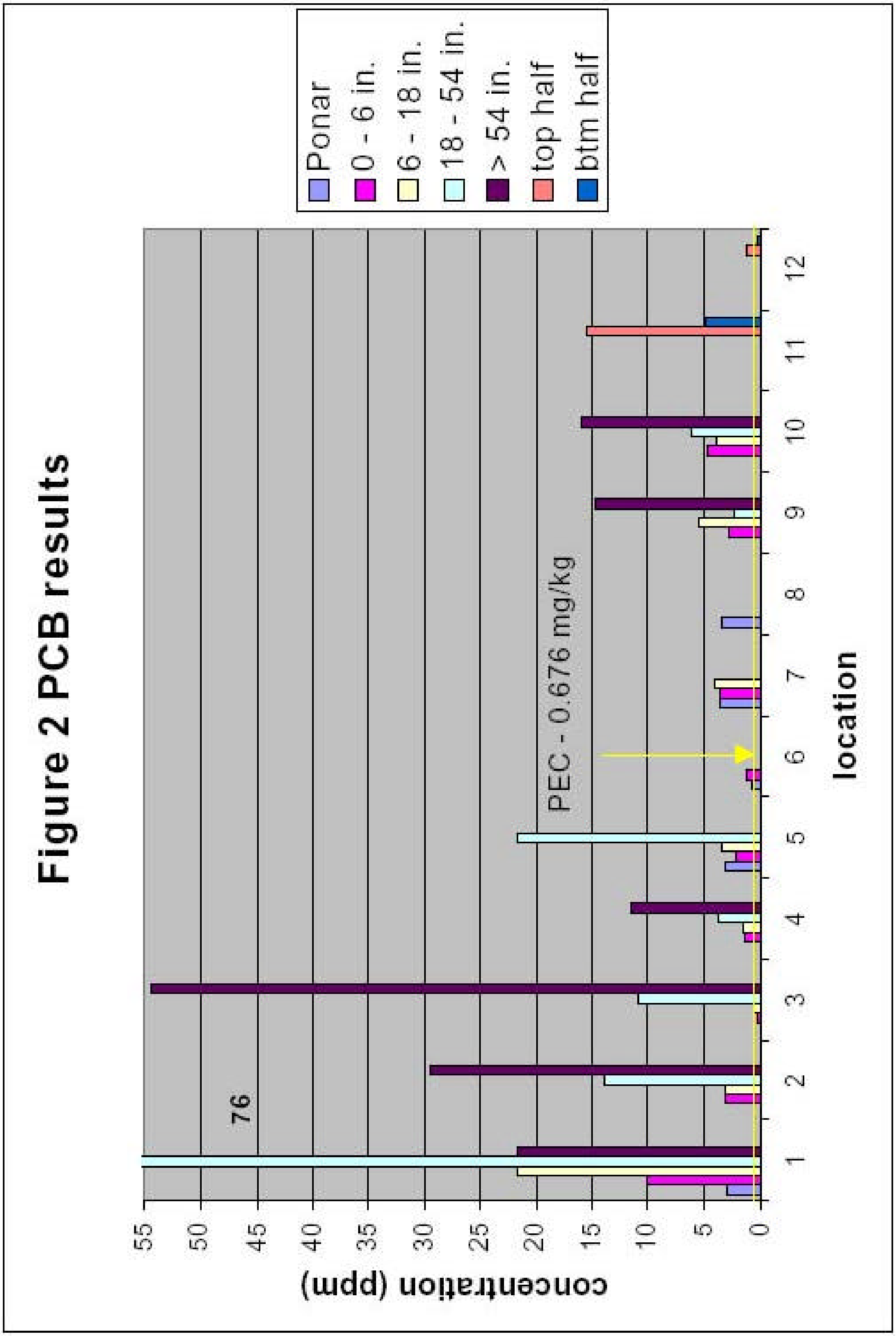

Figure 2 PCB results

TABLE 2. Contaminant Levels, TECs, and PECs for Chicago River Sediments

	Maximum Concentration	Threshold Effects Concentration (TEC)	Probable Effects Concentration (PEC)	Percent (%) of samples over TEC	Percent (%) of samples over PEC	Percent (%) of samples 3X over PEC
PCBs (ppm)	76	0.059	0.676	100%	94%	83%
PAHs (ppm)	721	1.61	22.8	100%	98%	46%

PAHs

PAH contamination appears to be higher in the South Branch of the river than in the North Branch and all of the samples in both branches exceed the PEC for PAHs except ChR00-04-B (6"-18" interval), which exceeds the TEC. In location ChR00-10, the deepest sample (below 54 inches) has a PAH concentration of 721 ppm, and locations ChR00-11 and ChR00-12 both have PAH levels around 350 ppm in the bottom half of the core. It should also be noted that for locations ChR00-11 and ChR00-12, the core was split into only two sections, the top half and bottom half, so these locations will need to be further evaluated to vertically delineate PAH contamination at these locations. Concentrations decrease in the North Branch of the river with only one deep sample above 140 ppm (ChR-00-03D) with most other samples below 50 ppm. Since a majority of the samples exceed the PEC, PAHs should be considered a primary contaminant of concern. The average PAH concentration for the 0 – 6 inch layer is 58.5 ppm compared to the PEC of 22.8 ppm. Table 2 suggests that 98% of the samples analyzed for PAHs exceeded the PEC, while 46% of the samples were 3 times the PEC for PAHs. Figure 3 depicts the total PAH concentration range for the locations sampled during this survey. Based on these results, PAHs should be considered a primary contaminant of concern in the river.

Oil and Grease

Samples analyzed for oil and grease indicate that all but two samples fall above the guideline of 2,000 mg/kg for “heavily polluted” sediments that were established by the U.S. EPA (1977). One sample, ChR00-05, had elevated concentrations of oil and grease in the surficial sediment, over 50,000 mg/kg. Other sampling results show an increased level of contamination in two locations on the South Branch of the river, while the North Branch depicts lower concentrations starting in the surficial sediment and increasing in contamination with depth. Again, it should also be noted that for locations ChR00-11 and ChR00-12, the core was split into only two sections, the top half and bottom half, so these locations will need to be further evaluated to determine the extent of oil and grease contamination at these locations. The average oil and grease concentration for the 0 – 6 inch layer is 9,495 mg/kg compared to the EPA Guideline of 2,000 mg/kg. Figure 4 shows the oil and grease concentration range for the locations sampled during this survey. Based on these results, oil and grease should be considered a primary contaminant of concern in the river.

Dioxins and Furans

Eleven samples were collected and analyzed for dioxins and furans and their cumulative toxic equivalents (TEQs) were calculated using each dioxin/furan's toxic equivalency factor (TEF). These numbers were then normalized to each sample's total organic carbon (TOC) content and compared to the New York State Department of Environmental Conservation (NYSDEC, 1999) TEQ wildlife and human health criteria. Results indicate that all eleven samples exceeded the TEQ wildlife criteria of 0.2 ug/kg OC, but remained below the human health level of 10.0 ug/kg OC. Results were also calculated for total dioxin and total furan homologs and compared to the NYSDEC qualitative background (>1,000 parts per trillion [ppt] for dioxins and >100 ppt for furans) and severe (>25,000 ppt for dioxins and >2,500 ppt for furans) contaminant levels. Total furan homologs exceeded the severe contaminant level for all but one sample, ChR00-05-B at 2,450 ppt, which exceeded the background level. A maximum result of 10,800 ppt was found at ChR00-02-D-FR for total furan homologs. Seven samples calculated for total dioxin homologs exceeded the severe contaminant level, with one sample result over 3 times the level (80,910 ppt at ChR002-02-D). The remaining four samples all exceeded the background contaminant level. Based upon these results dioxins/furans should be considered a primary contaminant of concern in the Chicago River.

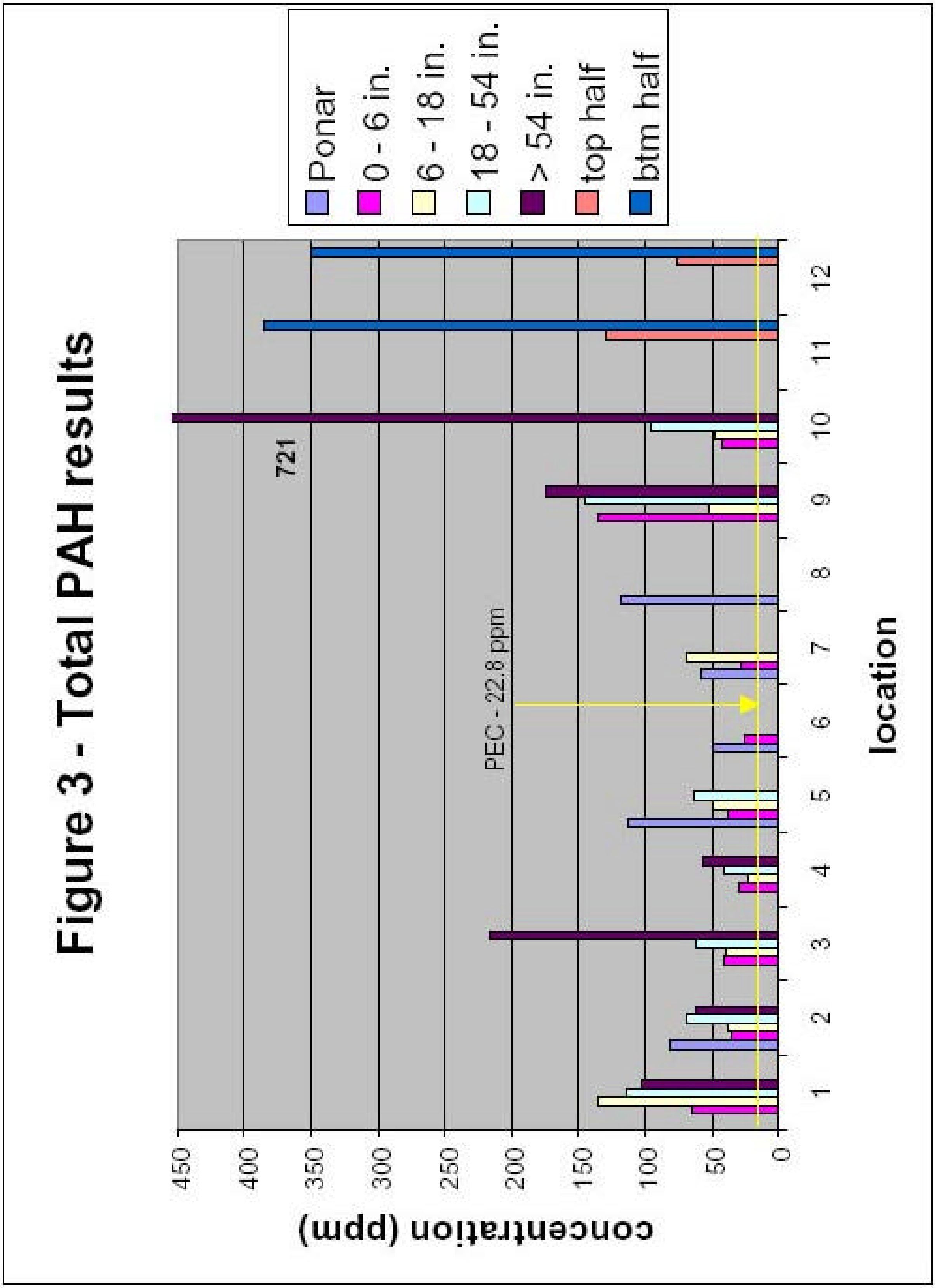
Figure 3 - Total PAH results
concentration (ppm)
450
400
350
300
250
200
150
100
50
0
location
1
2
3
4
5
6
7
8
9
10
11
12
721
PEC - 22.8 ppm
Ponar
0 - 6 in.
6 - 18 in.
18 - 54 in.
> 54 in.
top half
btm half

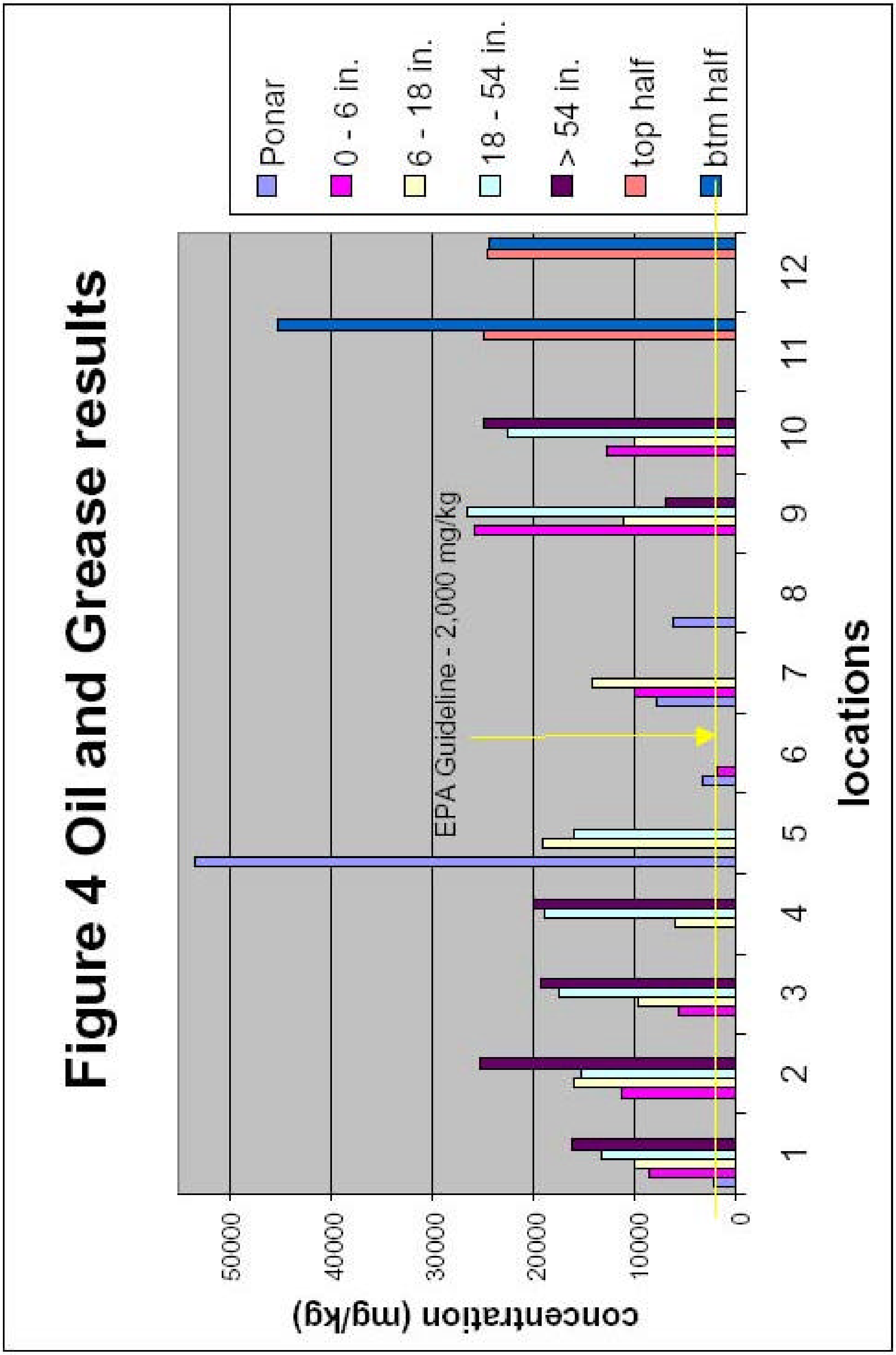
Figure 4 Oil and Grease results
concentration (mg/kg)
50000
40000
30000
20000
10000
0
1
2
3
4
5
6
7
8
9
10
11
12
locations
EPA Guideline - 2,000 mg/kg
Ponar
0 - 6 in.
6 - 18 in.
18 - 54 in.
> 54 in.
top half
btm half

4.2 SEDIMENT TOXICITY RESULTS

Toxicity testing using 28-day *Hyalella azteca* (HA28) and 10-day *Chironomous tentans* (CT10) were performed on several ponar samples collected during the October 2000 survey to see if the contaminants present have acute or chronic toxic effects on benthic organisms. Due to laboratory error in completion of the dry weight/ash free dry weight data for the CT10 test, the growth endpoint was measured for only the HA28 toxicity test. As indicated in Table 3, results of the toxicity tests indicate that the contaminants had minimal toxic effects to benthic organisms, in terms of both survival and growth for both the HA28 test and for survival for the CT10 test. Only one location, ChR00-02P, showed a difference for both survival and growth when compared to the control sample, but this result should be considered suspect due to problems encountered with the dissolved oxygen (DO) levels. DO was found to be below the required standard of 2.5 mg/L for Replicate A (down to 0.85 mg/L) two days in a row. Since the percentage of survival of *H. azteca* for Replicate A for ChR00-02P was low (30%) and the other replicates were in the 60% - 100% survival range, the low DO levels, rather than a contaminant of concern, could have possibly been the cause of the significantly reduced survival in Replicate A.

TABLE 3: PEC-Q Levels and Toxicity Results for October 2000 Samples

Sample ID	*H. azteca* % mean survival	*C. tentans* % mean survival	H. azteca average growth
ChR00-02P	**75**	89	**0.0008**
ChR00-05P	93	88	0.0009
ChR00-05FDP	88	93	0.0010
ChR00-06P	93	90	0.0010
ChR00-07P	99	89	0.0009
ChR00-08P	97	94	0.0010
WBC Control	90	93	0.0010
Bold *indicates significant toxicity compared to the control*			

Five additional samples plus a duplicate were collected in August of 2002 at approximately the same locations from the 2000 study, and subjected to 10-day *Hyalella azteca* and 10-day *Chironomus tentans* whole sediment toxicity tests for both survival and growth to verify prior results. Both tests indicate that several locations had reduced survival and growth, but the CT10 samples had QC issues, resulting from the high temperature of samples received at the laboratory. Therefore, the CT10 data was not used in this report. Data from the HA10 survival analysis indicated that ChR00-02P, the duplicate of ChR00-02P, ChR00-05P, and ChR00-08P are all statistically significant from the control sample. Samples ChR00-02P and its duplicate showed organism survival of less than 30%, and 0% was observed from ChR00-08P. The results of the HA10 growth data showed that all samples were statistically significant to the control. It should be noted that samples ChR00-02P and its duplicate contained a large number of indigenous oligochaetes, which can impact the growth of amphipods in a 28-day exposure, and since this was only a 10-day exposure and the weights are so small, the results should be interpreted with care.

Based upon the 2002 toxicity data, there is a potential for both acute and chronic effects stemming from the contaminated sediment in the Chicago River. However, since samples were collected at only five locations along this section of the river, and the 2000 and the 2002 toxicity assessments provided conflicting results, additional samples should be collected and analyzed for whole toxicity tests to provide a more thorough representation of the potential toxicity of Chicago River sediments.

4.3 CONTAMINATION AT DEPTH

In order to gain some insight into the potential impact of sediment contamination within the North and South Branch of the Chicago River system, Probable Effects Concentration Quotient (PEC-Q) values were calculated according to the method described in USEPA (2000). PEC-Qs attempt to quantify all sediment chemistry data into a single scoring system. Individual PEC quotients are calculated by dividing the sample chemical concentration by the corresponding PEC value for that chemical. A sample PEC-Q is then calculated by averaging the individual PEC quotients for all chemicals.

As discussed earlier, sediment contamination in the Chicago River system tends to increase with depth. Table 4 depicts the average of the combined PEC-Q values for the surficial ponar grab sample and each individual layer of the core sample. By looking at the PEC-Q values in this table, it is clear that the average value significantly increases with the depth of the sample, especially in the two deepest layers, Slice C and Slice D. This table also shows that the average PEC-Q value for the two surficial profiles (the surficial ponar layer and Slice A), are very close in value, indicating that the data in the table is reliable to use in comparing the PEC-Q values for each section analyzed. Samples ChR00-11 and ChR00-12 were not included in this table since the layers were not sampled according to the depth interval of 0-6 inches, 6-18 inches, 18-54 inches, and > 54 inches, but were instead split in half.

TABLE 4. Sediment Layer Comparison Using PEC-Q Values

	Depth Interval	Number of Samples	Average PEC-Q
Surficial Ponar	0 – 6 inches	6	2.02
Slice A	0 – 6 inches	10	2.24
Slice B	6 – 18 inches	10	3.33
Slice C	18 – 54 inches	10	7.79
Slice D	> 54 inches	8	9.62

5. QA/QC EVALUATION OF LABORATORY DATA

After receipt of the chemical and toxicity data from the laboratory, GLNPO and an independent contractor conducted a QA/QC review of the data packages submitted by the laboratory. During this review, three major discrepancies were identified. The first problem was noted with 10-day *C. tentans* toxicity testing measuring for growth where the laboratory failed to weigh the species prior to incinerating the midge in order to determine the true weight of the invertebrate, minus the gut contents. The second problem was noted with the oil and grease results from one specific sample, ChR00-05-A, where the result was extremely high, 1,530,000 mg/kg. This sample was not evaluated in this report due to the elevated result, but it should be noted that the surficial ponar sample in this area (ChR00-05-P) was also very high (53,400 mg/kg) and this area should be resampled in any future sampling event. Finally, the other major QA/QC issue found in the data related to the total petroleum hydrocarbon (TPH) analysis. The laboratory failed to analyze the laboratory control samples and the matrix spike/matrix spike duplicate (MS/MSD) samples with any of the analytical batches, making the TPH results invalid since it was no longer possible to evaluate the contribution of any matrix effects. None of the above results were used in this report.

Additionally, a few minor problems were encountered with various analyses relating to matrix interferences, reporting limits, and MS/MSD samples. Based on a thorough review of the QA/QC data and analysis methods, it was determined that the majority of the results are valid and usable for screening level purposes.

5.1 FIELD REPLICATES AND FIELD DUPLICATES

In order to obtain insight into the inherent variability in the sample collection and analysis process, field duplicates and field replicates were collected and analyzed. A field duplicate is a single sample, core, or ponar that is collected and homogenized, and then split into two separate samples for redundant laboratory analysis. Field replicates are a second sample, core, or ponar, collected in essentially the same immediate location as the routine field sample. Comparison of field duplicates and field replicates to the corresponding routine field samples provides insight into the variability of the sampling and analysis process, including the spatial variability of contaminant concentrations at the site.

An analysis of the relative percent difference (RPD) between routine field samples and their corresponding duplicate and/or replicate for the Chicago River system reveals a moderate variability in the sampling and analysis process for PAHs and a low to moderate variability for PCBs, dioxins and furans, a few metals, and various wet chemistry data, including oil and grease and total phosphorous. RPDs for field duplicates exhibited higher variability than field replicates for oil and grease and metals indicating that the potential lack of homogeneity of sediments may have contributed to these results. PAH data indicates that the duplicate samples for ChR00-01-D may be having the same effect since the duplicates exhibit more variability than replicates at this location, however for ChR00-02-C, the replicate exhibits much higher variability indicating that spatial variability of the sampling site may have contributed to the discrepancy in the RPDs. Also, several data sheets were missing from the data validation packages, so these samples could not be fully evaluated to determine the RPD, and many other sample pairs had one sample result as a non-detect making the calculation for RPD unusable. Therefore, the PAH data should only be used for screening level purposes, but all other data appear to be of relatively high quality.

5.2 MATRIX SPIKES AND MATRIX SPIKE DUPLICATES

The majority of the matrix spike and matrix spike duplicate analyses were within the control limits for all samples and all parameters. The few exceptions were largely with the PAH data, and on a smaller scale with total phosphorous, PCBs and total cyanide. The PAH data should only be used for screening level purposes, but all other data appear to be of relatively high quality

6. CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the GLNPO survey conducted in the North and South Branches of the Chicago River in 2000 and 2002, the authors have drawn the following conclusions:

- PAH concentrations, especially in the South Branch of the river are elevated and potentially present an ecological and/or human health threat;
- PAHs, oil and grease, dioxins and furans and PCBs are the primary contaminants of concern, with metals a secondary contaminant of concern, identified in the sediments throughout the Chicago River system;
- Heavy metals including cadmium, copper, chromium, lead and zinc all have high levels of contamination, but based upon SEM/AVS analysis during this survey these metals were not bioavailable to the benthic community in the surficial sediment except in locations on the South Branch of the river (ChR00-07 and ChR00-08). Additional SEM/AVS analyses should be performed for any future sampling that is planned to ensure that metals, in fact, are not bioavailable;
- Sediments in the Main Branch, near Lakeshore Drive, are significantly less contaminated than other portions of the river;
- PCB contamination appears to be higher in the deeper sediments in the North Branch of the river than in the South Branch
- Overall, the surficial sediments are less contaminated than the deeper sediments throughout the river system for the primary contaminants of concern, including metals.

Based upon these conclusions, GLNPO offers the following recommendations for the site:

- Collect additional samples at ChR00-05 to determine if the extremely elevated concentration for oil and grease in the surficial sediments accurate;
- Collect additional samples at ChR00-11 and ChR00-12 and section the samples according to how they were sectioned for this study (0-6 in., 6-18 in., 18-54 in., > 54 in.) to determine the vertical extent of contamination for PAHs, oil and grease, and metals in each section;
- Perform a benthic community assessment to more fully understand if the elevated chemistry levels are affecting the benthic community in the Chicago River system;
- Perform bioaccumulation studies in the North Branch to determine potential uptake of PCBs and dioxins/furans;
- Collect additional samples along the entire study area for toxicity testing and analyze using 10-day *Chironomus tentans* and 28-day *Hyalella azteca*; and
- Incorporate and evaluate other existing data sets to more fully understand the extent of contamination on the Chicago River and consider additional sampling to fully delineate the extent of contamination in the river
- Coordinate with other stakeholders (Chicago Department of the Environment, Illinois EPA, etc.) to formulate a strategy for addressing sediment contamination in the Chicago River; and
- Consider instituting regular sampling (every 5 years or so) to evaluate changes in surficial sediment concentrations.

7. REFERENCES

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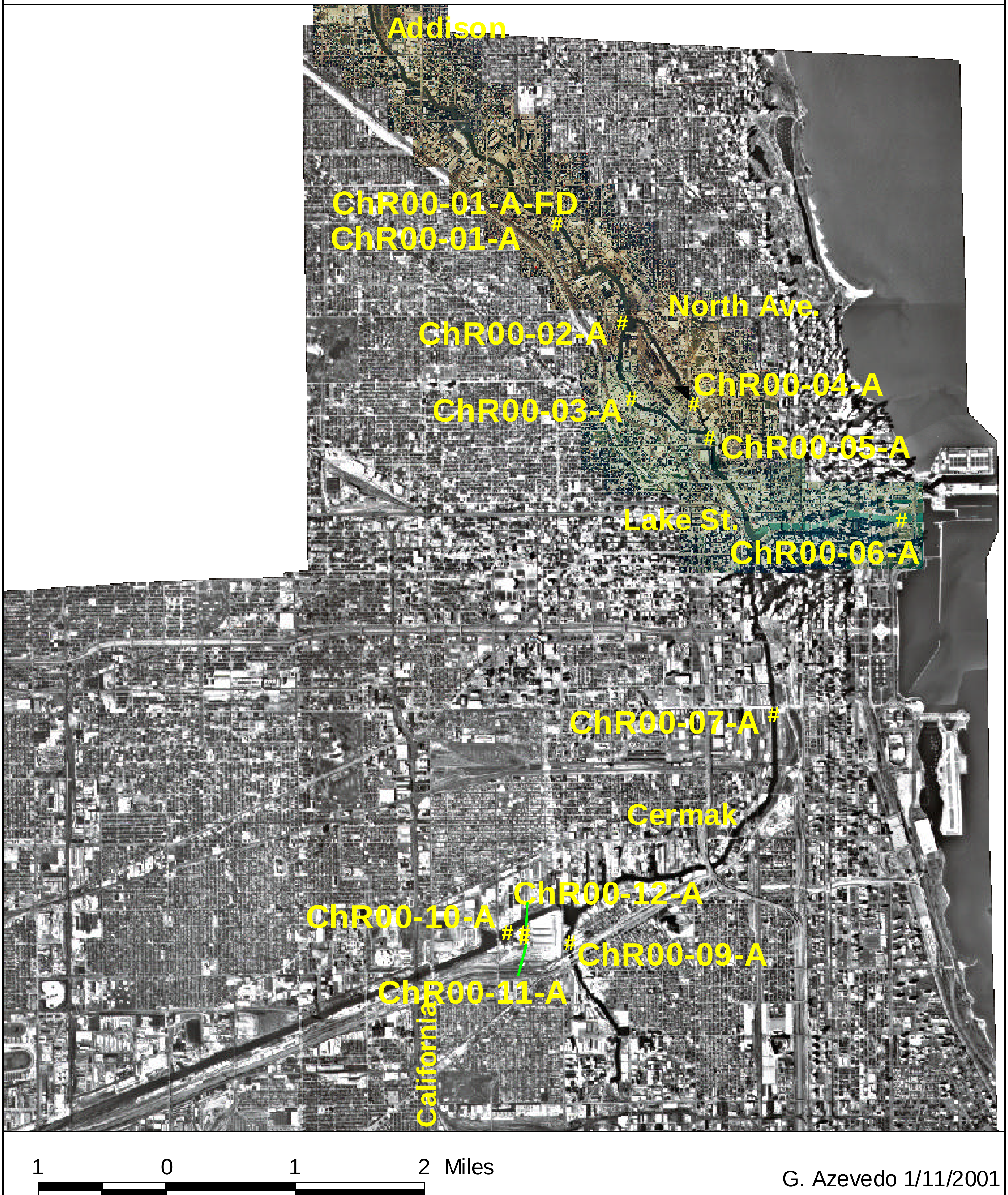
NORTH & SOUTH BRACH CHICAGO RIVER

Sampling Sites



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Appendix B-1 - SEM/AVS Relative Percent Difference Table

Field Duplicate (FD) Results for Chicago River Sediment Sampling, October 2000

Analytes	ChR00-05-P (mg/kg)	ChR00-05-P-FD (mg/kg)	RPD
AVS	817	775	5.3 %
cadmium	11.6	14.5	22.2 %
copper	108	72.3	39.6 %
lead	194	212	8.9 %
mercury	ND	ND	0 %
nickel	27.8	36.7	27.6 %
zinc	820	837	2.1 %

ND = non-detect

Appendix B-2 - Classical Wet Chemistry Relative Percent Difference Table

Field Duplicate (FD) Results (mg/kg) for Chicago River Sediment Sampling, October 2000

Analytes	ChR00-01-A	ChR00-01-A-FD	RPD	ChR00-01-B	ChR00-01-B-FD	RPD	ChR00-01-C	ChR00-01-C-FD	RPD	ChR00-01-D	ChR00-01-D-FD	RPD	ChR00-05-P	ChR00-05-P-FD	RPD
% solids	40.0%	44.7%	11%	52.0%	57.8%	11%	54.6%	51.9%	5%	48.6%	48.4%	0%	33.4%	33.3%	0%
% moisture	60.0%	55.3%	8%	48.0%	42.2%	13%	45.4%	48.1%	6%	51.4%	51.6%	0%	66.6%	66.7%	0%
% ash	87.0%	87.0%	0%	88.7%	89.4%	1%	85.2%	83.5%	2%	81.9%	82.8%	1%	88.4%	88.8%	0%
COD	147,000	154,000	5%	206,000	153,000	30%	277,000	100,000	**94%**	293,000	287,000	2%	208,000	248,000	18%
TKN	4260	3840	10%	3090	3420	10%	5960	4620	25%	7300	7440	2%	4320	3480	22%
Oil & Grease	8640	16,600	**63%**	10,000	9690	3%	13,400	21,600	**47%**	16,100	15,300	5%	534,00	9100	**142%**
Total Phosphorous	ND	24.6	Ind	116	77.9	39%	13.3	74.4	**139%**	4.8	ND	Ind	15.6	60.4	**118%**
TOC	49,000	74,000	**41%**	75,600	73,800	2%	93,400	98,000	5%	94,600	67,200	34%	60,300	63,100	5%
Ammonia as N	820	960	16%	400	860	**73%**	1800	1500	18%	2400	2700	12%	740	650	13%
Total Cyanide	5.0	4.7	6%	18.4	14.9	21%	5.6	9.5	**52%**	6.9	12.5	**58%**	0.3	2.3	**15**

ND = non-detect
Ind = indeterminate
NA = not analyzed

Appendix B-2 (Continued)

Field Replicate (FR) Results (mg/kg) for Chicago River Sediment Sampling, October 2000

Analytes	ChR00-02-C	ChR00-02-C-FR	RPD	ChR00-02-D	ChR00-02-D-FR	RPD	ChR00-05-B	ChR00-05-B-FR	RPD	ChR00-05-C	ChR00-05-C-FR	RPD
% solids	40.0%	39.1%	2%	40.8%	41.3%	1%	38.9%	37.0%	5%	52.4%	52.4%	0%
% moisture	60.0%	60.9%	1%	59.2%	58.7%	1%	61.1%	63.0%	3%	47.6%	47.6%	0%
% ash	83.1%	83.3%	0%	81.4%	81.2%	0%	81.0%	86.7%	7%	88.9%	88.6%	0%
COD	562,000	367,000	42%	310,000	339,000	9%	240,000	281,000	16%	185,000	240,000	26%
TKN	5730	7680	29%	8760	9150	4%	4320	5500	24%	3780	3840	2%
Oil & Grease	15100	20,600	31%	25,200	31,300	22%	19,100	17,600	8%	16,000	16,600	4%
TPH	3780	5720	41%	6260	9950	46%	6250	NA	Ind	7280	NA	Ind
Total Phosphorous	10.5	1990	**198%**	229	122	**61%**	1920	2920	41%	52.2	280	**137%**
TOC	83000	86,400	4%	100,000	83,800	18%	69,200	69,400	0%	77,900	63,600	20%
Ammonia as N	1900	3500	**59%**	4300	4500	5%	810	1000	21%	1300	1200	8%
Total Cyanide	6.2	9	37%	26.4	28.1	6%	5.2	4.3	9%	5.9	5.6	5

ND = non-detect
Ind = indeterminate
NA = not analyzed

Appendix B-3 - Dioxin/Furan Relative Percent Difference Table

Field Replicate Precision Results for Chicago River Sediment Sampling, October 2000

Analytes	ChR00-02-C FR (ng/kg)	ChR00-02-D FR (ng/kg)	RPD
2,3,7,8-TCDD	94	38	**85**
1,2,3,7,8-PeCDD	95	96	22
1,2,3,4,7,8-HxCDD	38	41	8
1,2,3,6,7,8-HxCDD	220	300	31
1,2,3,7,8,9-HxCDD	210	190	10
1,2,3,4,6,7,8-HpCDD	4200	5500 E	27
OCDD	41,000 E	64,000 E	44
2,3,7,8-TCDF	37 CON	56 CON	41
1,2,3,7,8-PeCDF	27	31	14
2,3,4,7,8-PeCDF	34	45	28
1,2,3,4,7,8-HxCDF	95	130	31
1,2,3,6,7,8-HxCDF	54	60	11
1,2,3,7,8,9-HxCDF	ND	ND	Indeterminate
2,3,4,6,7,8-HxCDF	38	39	3
1,2,3,4,6,7,8-HpCDF	950	1200	23
1,2,3,4,7,8,9-HpCDF	63	67	6
OCDF	2400	2700	12
Total TCDD	490	280	**55**
Total PeCDD	690	530	26
Total HxCDD	2300	3100	30
Total HpCDD	8900	13,000	37
Total TCDF	620	980	45
Total PeCDF	710	910	25
Total HxCDF	1300	1500	14
Total HpCDF	2800	3500	22

ND = Non-detect
CON = Results reported from the confirmation column (DB-225) per method specifications
E = Result exceeded calibration range

FR = Field Replicate

Appendix B-4 - Metals Relative Percent Difference Table

Field Duplicate Results (mg/kg) for Chicago River Sediment Sampling, October 2000

Analytes	ChR00-01-A	ChR00-01-A-FD	RPD	ChR00-01-B	ChR00-01-B-FD	RPD	ChR00-01-C	ChR00-01-C-FD	RPD	ChR00-01-D	ChR00-01-D-FD	RPD	ChR00-05-P	ChR00-05P-FD	RPD
arsenic	7.4	8.3	11 %	7.0	9.0	25 %	12.6	13.2	5 %	13.5	16.5	20 %	6.8	8.6	23 %
barium	388	334	15 %	271	308	13 %	429	445	4 %	431	448	4 %	262	272	4 %
cadmium	36.5	52.2	35 %	48.2	47.9	1 %	60.4	64.3	6 %	52.2	60.2	14 %	18	23.7	27 %
chromium	328	376	14 %	274	293	7 %	534	583	9 %	484	621	25 %	158	198	22 %
copper	441	445	1 %	334	368	10 %	506	533	5 %	501	571	13 %	288	317	10 %
iron	19400	16900	14 %	17000	18300	7 %	20000	21700	8 %	19700	22600	14 %	22200	20000	10 %
lead	601	964	**46 %**	660	765	15 %	778	796	2 %	753	757	1 %	306	348	13 %
manganese	320	271	17 %	305	316	4 %	315	328	4 %	265	313	17 %	319	295	8 %
mercury	1.1	2.0	**58 %**	2.6	3.1	18 %	3.4	3.8	11 %	3.8	3.1	20 %	1.0	1.2	18 %
nickel	125	209	**50 %**	177	201	13 %	174	162	7 %	170	150	13 %	79.1	91.9	15 %
selenium	121.1	1.6	37 %	1.3	1.2	8 %	2.0	1.4	35 %	2.7	2.4	12 %	0.7	0.91	26 %
silver	14.6	21.5	38 %	11.7	13.0	11 %	22.4	18.5	19 %	16.7	18.6	11 %	15.6	17.9	14 %
zinc	1260	1460	15 %	1090	1200	10 %	2010	2040	1 %	2160	2230	3 %	850	973	13 %

Appendix B-4 (Continued)

Field Replicate Results (mg/kg) for Chicago River Sediment Sampling, October 2000

Analytes	ChR00-02-C	ChR00-02-C-FR	RPD	ChR00-02-D	ChR00-02-D-FR	RPD	ChR00-05-B	ChR00-05-B-FR	RPD	ChR00-05-C	ChR00-05C-FR	RPD
arsenic	8.6	9.6	11 %	10.9	10.7	2 %	8.1	8.7	7 %	11.2	9.0	22 %
barium	392	410	4 %	442	436	1 %	366	369	1 %	294	253	15 %
cadmium	56.9	62.5	9 %	99.5	96.5	3 %	40.0	38.4	4 %	84.0	78.8	6 %
chromium	431	498	14 %	700	693	1 %	320	317	1 %	530	455	15 %
copper	523	553	6 %	716	704	2 %	564	568	1 %	475	369	25 %
iron	19800	21300	7 %	20300	19800	2 %	21200	23000	8 %	16200	14000	15 %
lead	798	957	18 %	1150	1140	1 %	613	617	1 %	721	539	29 %
manganese	293	306	4 %	309	301	3 %	326	340	4 %	336	252	29 %
mercury	2.3	1.9	19 %	2.5	2.5	0 %	1.5	1.9	24 %	1.9	2.2	15 %
nickel	184	216	16 %	248	248	0 %	152	153	1 %	152	120	24 %
selenium	2.1	1.8	15 %	1.6	1.4	13 %	1.2	1.4	15 %	0.85	1.1	26 %
silver	23.3	25.9	11 %	30.8	32.0	4 %	18.4	18.5	1 %	17.5	14.4	19 %
zinc	1760	1960	11 %	2510	2420	4 %	1510	1540	2 %	1800	1550	15 %

Appendix B-5 - PCB Relative Percent Difference Table

Field Duplicate (FD) Precision Results for Chicago River Sediment Sampling, October 2000
Unit = ug/kg

Analytes	ChR00-01-A	ChR00-01-A-FD	RPD	ChR00-01-B	ChR00-01-B-FD	RPD	ChR00-01-C	ChR00-01-C-FD	RPD	ChR00-01-D	ChR00-01-D-FD	RPD	ChR00-05-P	ChR00-05P-FD	RPD
PCB 1016	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%
PCB 1221	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%
PCB 1232	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%
PCB 1242	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%	2700	2600	4%
PCB 1248	8900	7400	18%	20,000	18,000	11%	76,000	83,000	9%	20,000	27,000	**30%**	ND	ND	0%
PCB 1254	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%
PCB 1260	1100	1300	17%	1800	1600	12%	ND	4600	**Ind**	1800	ND	**Ind**	410	350	16%

ND = Non-detect
Ind = Indeterminate

Appendix B-5 (Continued)

Field Replicate (FR) Precision Results for Chicago River Sediment Sampling, October 2000
Unit = ug/kg

Analytes	ChR00-02-C	ChR00-02-C-FR	RPD	ChR00-02-D	ChR00-02-D-FR	RPD	ChR00-05-B	ChR00-05-B-FR	RPD	ChR00-05-C	ChR00-05C-FR	RPD
PCB 1016	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%
PCB 1221	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%
PCB 1232	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%
PCB 1242	12,000	11,000	9%	26,000	22,000	17%	3000	3400	13%	20,000	24,000	18%
PCB 1248	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%
PCB 1254	ND	ND	0%	ND	ND	0%	ND	ND	0%	ND	ND	0%
PCB 1260	1900	1500	**24%**	3500	3000	15%	460	530	14%	1600	2000	**22%**

ND = Non-detect
Ind = Indeterminate

Appendix B-6

Individual PAH - Field Duplicate (FD) Results for Chicago River Sediment Sampling, October 2000

Analytes	ChR00-01-A	ChR00-01-A-FD	RPD	ChR00-01-B	ChR00-01-B-FD	RPD	ChR00-01-C	ChR00-01-C-FD	RPD	ChR00-01-D	ChR00-01-D-FD	RPD	ChR00-05-P	ChR00-05P-FD	RPD
Napthalene	350	340	3%	670	710	6%	**M**	670	**Ind**	820	440	**60%**	270	320	17%
Acenaphthylene	160	190	17%	610	650	6%	**M**	410	**Ind**	ND	170	**Ind**	820	320	**88%**
Acenapthene	610	780	24%	1500	ND	**Ind**	**M**	1300	**Ind**	1000	510	**65%**	560	240	**80%**
Fluorene	910	1000	9%	2100	2200	5%	1900	2000	5%	1800	980	**59%**	880	230	**117%**
Phenanthrene	7000	6600	6%	16,000	18,000	6%	13,000	11,000	8%	10,000	5900	**52%**	8200	7700	6%
Anthracene	1100	1400	24%	3900	3900	0%	2200	2100	5%	1800	910	**66%**	1700	2200	26%
Fluoranthene	11,000	9200	18%	24,000	24,000	0%	20,000	17,000	16%	17,000	8100	**71%**	16,000	13000	21%
Pyrene	11,000	9300	17%	25,000	28,000	11%	18,000	19,000	5%	16,000	8400	**62%**	22,000	21,000	5%
Benzo(a) anthracene	5000	4700	6%	11,000	12,000	9%	9300	9300	0%	7700	4600	**50%**	9800	9300	5%
Chrysene	5500	5900	7%	13,000	15,000	14%	12,000	11,000	9%	10,000	4900	**68%**	10,000	7900	23%
Benzo(b) fluoranthene	6000	5100	16%	8800	8100	8%	9200	7900	15%	8700	5200	**50%**	8000	ND	**Ind**
Benzo(k) fluoranthene	3500	3500	0%	6200	6400	3%	6600	8400	24%	5800	2800	**70%**	9800	ND	**Ind**
Benzo(a)pyrene	4400	4700	7%	8600	12,000	33%	7900	8400	6%	7000	3700	**62%**	9400	ND	**Ind**
Indeno(1,2,3-cd) pyrene	2800	3000	7%	5300	5800	9%	4800	5100	6%	4400	2500	**55%**	5800	5400	7%
Benzo(g,h,i) perylene	2800	3600	25%	5300	5500	4%	4700	5000	6%	4100	2500	**52%**	7100	6600	7%
Dibenzo(a,h) anthracene	1100	1400	24%	2800	3000	7%	2000	2000	0%	1700	980	**54%**	2600	ND	**Ind**
2-methyl-naphthalene	400	670	**50%**	1300	1300	0%	**M**	ND	**Ind**	ND	590	**Ind**	470	420	11%
Dibenzofuran	370	400	8%	740	860	15%	530	590	11%	550	360	**42%**	340	120	**96%**

Appendix B-6 (Continued)

Individual PAH - Field Replicate (FR) Results for Chicago River Sediment Sampling, October 2000

Analytes	ChR00-02-C	ChR00-02-C-FR	RPD	ChR00-02-D	ChR00-02-D-FR	RPD	ChR00-05-B	ChR00-05-B-FR	RPD	ChR00-05-C	ChR00-05C-FR	RPD
Napthalene	ND	180	**Ind**	ND	ND	--	ND	ND	--	ND	ND	--
Acenaphthylene	ND	ND	--	ND	ND	--	ND	ND	--	ND	810	**Ind**
Acenapthene	ND	340	**Ind**	680	680	0%	ND	420	**Ind**	1700	2100	21%
Fluorene	ND	420	**Ind**	**M**	1200	**Ind**	ND	570	**Ind**	1600	2100	27%
Phenanthrene	7800	3200	**84%**	**M**	8700	**Ind**	5000	4000	22%	8700	11,000	23%
Anthracene	1300	620	**71%**	**M**	1600	**Ind**	910	760	18%	2500	3100	21%
Fluoranthene	13,000	4900	**91%**	**M**	14,000	**Ind**	8800	5900	39%	9200	11,000	18%
Pyrene	11,000	6100	**57%**	**M**	11,000	**Ind**	8300	8600	4%	9300	12,000	25%
Benzo(a)anthracene	5100	2800	**58%**	**M**	5300	**Ind**	3800	3600	5%	4700	7600	47%
Chrysene	7600	3200	**81%**	**M**	7500	**Ind**	5700	4400	26%	5600	9000	47%
Benzo(b) fluoranthene	5800	2900	**67%**	**M**	6300	**Ind**	4400	3800	15%	3300	6400	**64%**
Benzo(k) fluoranthene	5400	1500	**113%**	**M**	4800	**Ind**	3900	2500	44%	4300	5100	17%
Benzo(a)pyrene	5200	2200	**81%**	**M**	5100	**Ind**	3900	3200	20%	4400	7300	50%
Indeno(1,2,3-cd) pyrene	3200	2000	46%	**M**	3400	**Ind**	2700	2700	0%	2600	3100	18%
Benzo(g,h,i) perylene	2900	1700	**52%**	**M**	M	**Ind**	2200	2400	9%	2100	2900	32%
Dibenzo(a,h) anthracene	ND	600	**Ind**	**M**	ND	**Ind**	ND	1000	**Ind**	ND	1100	**Ind**
2-Methylnaphthalene	ND	ND	--	ND	ND	--	ND	ND	–	2500	3600	36%
Dibenzofuran	ND	170	**Ind**	**M**	ND	**Ind**	ND	200	**Ind**	ND	ND	--

Appendix B-6 (Concluded)

Field Replicate (FR) Results for Chicago River Sediment Sampling, October 2000

Analytes	ChR00-02-C	ChR00-02-C-FR	RPD	ChR00-02-D	ChR00-02-D-FR	RPD
Acetone	200	230	14%	ND	ND	0%
Toluene	**M**	12	**Ind**	30	78	**89%**
m&p-Xylenes	**M**	18	**Ind**	32	ND	**Ind**
o-Xylene	**M**	14	**Ind**	20	95	**130%**
1,3,5-Trimethylbenzene	**M**	25	**Ind**	34	ND	**Ind**
1,24-Trimethylbenzene	**M**	58	**Ind**	82	290	**112%**
1,4-Dichlorobenzene	11	ND	**Ind**	ND	42	**Ind**
Ethylbenzene	ND	ND	0%	5	24	**131%**
n-Propylbenzene	ND	ND	0%	ND	45	**Ind**
sec-Butylbenzene	ND	ND	0%	ND	38	**Ind**
p-Isopropyltoluene	ND	ND	0%	33	94	**96%**
n-Butylbenzene	ND	ND	0%	ND	84	**Ind**

Appendix C
Ponar Samples

Parameter	Units	TEC	PEC	ChR00-02-P	PEC-Q-02-P	ChR00-05-P	PEC-Q-05-P	ChR00-06-P	PEC-Q-06-P	ChR00-07-P	PEC-Q-07-P	ChR00-08-P	PEC-Q-08-P	ChR00-05-P-FD	PEC-Q-P-FD
Latitude	dd mm.mmmm			41 54.5779		41 53.8222		41 53.2838		41 52.0039		41 50.6825		41 53.8280	
Longitude	dd mm.mmmm			87 39.4452		87 38.6629		87 36.9466		87 38.0856		87 39.8022		87 38.6631	
Sample Date	dd-mm-yyyy			17-10-2000		17-10-2000		17-10-2000		17-10-2000		17-10-2000		17-10-2000	
Water Depth	inches			163		247		281		279		278		247	
Arsenic	mg/kg	**9.79**	**33.0**	8.2	0.25	6.8	0.21	8.8	0.27	7.3	0.22	5.9	0.18	8.6	0.26
Cadmium	mg/kg	**0.99**	**5.0**	10.4	2.08	18.0	3.60	3.4	0.68	13.9	2.78	11.7	2.34	23.7	4.74
Chromium	mg/kg	**43.4**	**111.0**	138.0	1.24	158.0	1.42	48.1	0.43	157.0	1.41	125.0	1.13	198.0	1.78
Copper	mg/kg	**31.6**	**149.0**	267.0	1.79	288.0	1.93	103.0	0.69	324.0	2.17	260.0	1.74	317.0	2.13
Cyanide	mg/kg			0.32		0.3		0.26		0.88		1.3		2.3	
Lead	mg/kg	**35.8**	**128.0**	259.0	2.02	306.0	2.39	157.0	1.23	349.0	2.73	333.0	2.60	348.0	2.72
Mercury	mg/kg	**0.18**	**1.1**	2.8	2.64	1.0	0.94	1.9	1.79	1.2	1.13	0.9	0.88	1.2	1.13
Nickel	mg/kg	**22.7**	**49.0**	58.6	1.20	79.1	1.61	25.2	0.51	51.4	1.05	42.6	0.87	91.9	1.88
Phosphorous	mg/kg			60.0		15.6		8.9		130.0		88.9		60.4	
Zinc	mg/kg	**121**	**459.0**	815.0	1.78	850.0	1.85	269.0	0.59	896.0	1.95	710.0	1.55	973.0	2.12
2-Methylnaphthalene	ug/kg			420		470		460		450		1,300		420	
Acenaphthene	ug/kg			430		560		760		380		1,300		240	
Acenaphthylene	ug/kg			< 300		820		300		340		820		320	
Anthracene	ug/kg			6,600		1,700		1,700		5,000		2,500		2,200	
Benzo(a)anthracene	ug/kg			5,700		9,800		3,500		4,000		8,200		9,300	
Benzo(a)pyrene	ug/kg			5,700		9,400		3,700		<310		8,300		<230	
Benzo(b)fluoranthene	ug/kg			5,900		8,000		2,900		<350		9,500		<360	
Benzo(g,h,i)perylene	ug/kg			4,700		7,100		2,600		5,300		5,900		6,600	
Benzo(k)fluoranthene	ug/kg			7,700		9,800		4,600		<400		12,000		<310	
Chrysene	ug/kg			7,500		10,000		4,400		12,000		11,000		7,900	
Dibenz(a,h)anthracene	ug/kg			770		2,600		1,000		<390		1,900		<350	
Fluoranthene	ug/kg			12,000		16,000		7,400		9,900		16,000		13,000	
Fluorene	ug/kg			750		880		870		510		1,500		230	
Indeno(1,2,3-cd)pyrene	ug/kg			3,900		5,800		2,100		5,300		5,600		5,400	
Naphthalene	ug/kg			280		270		510		360		1,300		320	
Phenanthrene	ug/kg			6,600		8,200		5,500		1,500		10,000		7,700	
Pyrene	ug/kg			13,000		22,000		7,400		13,000		20,000		21,000	
Total PAHs	ug/kg	**1610**	**22800**	81,950	3.59	113,400	4.97	49,700	2.18	58,040	2.55	117,120	5.14	74,630	3.27
Total PCBs (Arochlors)	ug/kg	**59.8**	**676.0**	2,870.0	4.25	3,110.0	4.60	710.0	1.05	3,640.0	5.38	3,430.0	5.07	2,950.0	4.36
Chlordane	ug/kg			<120		<51		< 34		<57		<42		<100	
Dieldrin	ug/kg			< 25		<10		< 34		<11		<8		<20	
Sum DDD	ug/kg			120.0		160.0		42.0		100.0		57.0		110.0	
Sum DDE	ug/kg			170.0		95.0		39.0		84.0		52.0		110.0	
Sum DDT	ug/kg			< 27		<11		< 34		<12		<9		<22	
Total DDT	ug/kg			290.0		255.0		81.0		184.0		109.0		220.0	
Endrin	ug/kg			<32		<13		< 34		<14		<11		<26	
Heptachlor Epoxide	ug/kg			55.0		53.0		36.0		48.0		31.0		70.0	
Lindane	ug/kg			< 17		<7		< 17		<8		<6		<14	
Aldrin	ug/kg			< 10		<4		< 3		<4		<3		<8	
Mirex	ug/kg			< 7		<3		< 2		<3		<2		<6	

Appendix C
Ponar Samples

Parameter	Units	TEC	PEC	ChR00-02-P	PEC-Q-02-P	ChR00-05-P	PEC-Q-05-P	ChR00-06-P	PEC-Q-06-P	ChR00-07-P	PEC-Q-07-P	ChR00-08-P	PEC-Q-08-P	ChR00-05-P-FD	PEC-Q-P-FD
Toxaphene	ug/kg			< 340		<140		< 92		<150		<110		<270	
Octochlorostyrene	ug/kg			< 9		<4		< 2		<4		<3		<7	
SEM Cd	mg/kg			6.5		11.6		2.2		8.1		6.9		14.5	
SEM Cu	mg/kg			86.2		108.0		53.0		139.0		110.0		72.3	
SEM Pb	mg/kg			148.0		194.0		110.0		211.0		211.0		212.0	
SEM Ni	mg/kg			21.2		27.8		8.7		17.6		14.5		36.7	
SEM Ag	mg/kg			-		-		-		-		-		-	
SEM Zn	mg/kg			613.0		820.0		190.0		786.0		631.0		837.0	
AVS	mg/kg			909.0		817.0		162.0		307.0		330.0		775.0	
SEM	mmol			11.9		15.8		4.4		15.6		12.7		15.7	
AVS	mmol			28.4		25.5		5.1		9.6		10.3		24.2	
SEM/AVS	mmol			0.4		0.6		0.9		1.6		1.2		0.7	
TOC	mg/kg			74,700.0		60,300.0		47,200.0		66,100.0		66,600.0		63,100.0	
Oil & Gease	mg/kg			2,170.0		53,400.0		3,300.0		7,810.0		6,160.0		9,100.0	
SUM PEC-Q					20.84		23.54		9.42		21.38		21.50		24.40
PEC-Q					2.08		2.35		0.94		2.14		2.15		2.44
MAX PEC-Q					4.25		4.97		2.18		5.38		5.14		4.74

= Exceeds Threshold Effects Concentration (TEC) of MacDonald, et al. (2000)

= Exceeds Probable Effects Concentration (PEC) of MacDonald, et al. (2000)

= Exceeds 1.0 SEM/AVS Level

Appendix C

Core Information

Parameter	Units	ChR00-01	ChR00-01-FD	ChR00-02	ChR00-03	ChR00-04	ChR00-05	ChR00-06	ChR00-07	ChR00-09	ChR00-10	ChR00-11	ChR00-12
Latitude	dd mm.mmmm	41 55.2413	41 55.2419	41 54.5855	41 54.0837	41 54.0549	41 53.8224	4153.288	41 51.9868	41 50.4491	41 50.5133	41 50.4834	41 50.5161
Longitude	dd mm.mmmm	87 40.0498	87 40.0511	87 39.4600	87 39.3709	87 38.8139	87 38.6744	87 36.9522	87 38.0830	87 39.8770	87 40.4396	87 40.2868	87 40.2869
Sample Date	dd-mm-yyyy	19-10-2000	19-10-2000	19-10-2000	20-10-2000	19-10-2000	19-10-2000	20-10-2000	19-10-2000	18-10-2000	18-10-2000	18-10-2000	18-10-2000
Water Depth	inches	69	69	154	207	139	222	279	274	144	127	136	173
Depth of Penetration	inches	77	72	108		96	78		36	84	90	84	96

Appendix C

Core A

Parameter	Units	TEC	PEC	ChR00-01-A		PEC-Q-01-A	ChR00-01-A-FD		PEC-Q-01-A-FD	ChR00-02-A		PEC-Q-02-A	ChR00-03-A		PEC-Q-03-A	ChR00-04-A		PEC-Q-04-A	ChR00-05-A		PEC-Q-05-A	ChR00-06-A	
Latitude	dd mm.mmmm			41 55.2413			41 55.2419			41 54.5855			41 54.0837			41 54.0549			41 53.8224			4153.288	
Longitude	dd mm.mmmm			87 40.0498			87 40.0511			87 39.4600			87 39.3709			87 38.8139			87 38.6744			87 36.9522	
Water Depth	inches			69			69			154													
Sample Start Depth	inches			0			0			0			0			0			0			0	
Sample End Depth	inches			6			6			6			6			6			6			10	
Arsenic	mg/kg	**9.79**	**33.00**	7.4		0.22	8.3		0.25	6.6		0.20	6.9		0.21	6.9		0.21	6.9		0.21	8.7	
Cadmium	mg/kg	**0.99**	**5.00**	36.5		7.30	52.2		10.44	10.4		2.08	9.9		1.98	9.7		1.94	13.8		2.76	2.1	
Chromium	mg/kg	**43.40**	**111.00**	328.0		2.95	376.0		3.39	121.0		1.09	113.0		1.02	109.0		0.98	131.0		1.18	30.8	
Copper	mg/kg	**31.60**	**149.00**	441.0		2.96	445.0		2.99	282.0		1.89	250.0		1.68	261.0		1.75	263.0		1.77	62.7	
Cyanide	mg/kg			5.0			4.7			1.2			1.2			1.4			1.4			0.6	
Lead	mg/kg	**35.80**	**128.00**	601.0		4.70	964.0		7.53	237.0		1.85	253.0		1.98	234.0		1.83	253.0		1.98	181.0	
Mercury	mg/kg	**0.18**	**1.06**	1.1		1.04	2.0		1.89	1.4		1.32	1.1		1.04	0.9		0.83	4.0		3.77	1.3	
Nickel	mg/kg	**22.70**	**49.00**	125.0		2.57	209.0		4.30	52.8		1.09	49.9		1.03	47.3		0.97	54.8		1.13	22.7	
Phosphorous	mg/kg			<3.6	U		24.6			13.1	B		<9.2	U		<7.0	U		345.0			2.8	B
Zinc	mg/kg	**121.00**	**459.00**	1260.0		2.75	1460.0		3.18	894.0		1.95	764.0		1.66	800.0		1.74	860.0		1.87	167.0	
2-Methylnaphthalene	ug/kg			400	J		670	J		<520	U		<450			<530	U		<440	U		<260	
Acenaphthene	ug/kg			610	J		780			290	J		340	J		<330	U		<260	U		1,000	
Acenaphthylene	ug/kg			160	J		190	J		<310	U		<260			<310	U		<260	U		160	J
Anthracene	ug/kg			1,100			1,400			470	J		560	J		350	J		690	J		1,200	
Benzo(a)anthracene	ug/kg			5,000			4,700			2,800			2,900			2,200			2,900			1,700	
Benzo(a)pyrene	ug/kg			4,400			4,700			2,700			2,900			2,300			2,700			1,500	
Benzo(b)fluoranthene	ug/kg			6,000			5,100			3,500			4,500			3,900			3,100			1,600	
Benzo(g,h,i)perylene	ug/kg			2,800			3,600			2,100			2,200			1,900			1,400			750	
Benzo(k)fluoranthene	ug/kg			3,500			3,500			2,400			2,600			2,100			3,300			1,000	
Chrysene	ug/kg			5,500			5,900			3,600			3,800			3,300			3,800			1,900	
Dibenz(a,h)anthracene	ug/kg			1,100			1,400			830	J		770	J		590	J		710	J		270	J
Fluoranthene	ug/kg			11,000			9,200			5,900			6,800			5,000			6,900			4,300	
Fluorene	ug/kg			910			1,000			380	J		430	J		<270	U		400	J		1,100	
Indeno(1,2,3-cd)pyrene	ug/kg			2,800			3,000			2,000			2,300			1,800			1,800			670	
Naphthalene	ug/kg			350	J		340	J		<270	U		<230			<270	U		<230	U		280	J
Phenanthrene	ug/kg			7,000			6,600			3,000			3,300			2,000			4,000			4,300	
Pyrene	ug/kg			11,000			9,300			5,500			6,600			4,500			5,700			3,400	
Total PAHs	ug/kg	**1610**	**22800**	63,630		2.79	61,380		2.69	35,470		1.56	40,000		1.75	29,940		1.31	37,400		1.64	25,130	
Total PCBs (Arochlors)	ug/kg	**59.8**	**676.0**	10,000		14.79	8,700		12.87	3,220		4.76	180		0.27	1,380		2.04	2,080		3.08	1,110	
Chlordane	ug/kg			<42	U		<190	U		<63	U		<54	U		<3	U		<53	U		<31	U
Dieldrin	ug/kg			<8	U		<38	U		<13	U		<11	U		<13	U		<11	U		<6	U
4,4'-DDD	ug/kg			85			150	J		88			92			75			80			51	
4-4'-DDE	ug/kg			76			150	J		74			67			42	J		73			40	
4-4'-DDT	ug/kg			<9	U		<41	U		<14	U		<12	U		<14	U		<12	U		<7	U
Endrin	ug/kg			<11	U		<48	U		<16	U		<14	U		<16	U		<13	U		<8	U
Heptachlor Epoxide	ug/kg			64			68	J		<5	U		<4	U		<5	U		<4	U		18	
Lindane	ug/kg			<6	U		<26	U		<9	U		<7	U		<9	U		<7	U		<4	U
Aldrin	mg/kg			<3	U		<14	U		<5	U		<4	U		<5	U		<4	U		<2	U
Mirex	mg/kg			<2	U		<10	U		<3	U		<3	U		<3	U		<3	U		<2	U
Toxaphene	mg/kg			<110	U		<510	U		<170	U		<150	U		<170	U		<140	U		<85	U
Octochlorostyrene	mg/kg			<3	U		<13	U		<4	U		<4	U		<4	U		<4	U		<2	U
TOC	mg/kg			49,000			74,000			64,700			50,300			36,900			58,300			22,600	
% Solids	%			40.0			44.7			26.8			31.1			26.7			31.7			53.6	
% Moisture	%			60.0			55.3			73.2			68.9			73.3			68.3			46.4	
Oil & Gease	mg/kg			8,640			16,600			11,300			5,670			<1840	U		1,530,000			1,860	
COD	mg/kg			147,000			154,000			185,000			216,000			191,000			203,000			63,800	
SUM PEC-Q						42.1			49.5			17.8			12.6			13.6			19.4		
PEC-Q						4.21			4.95			1.78			1.26			1.36			1.94		
MAX PEC-Q						14.79			12.87			4.76			1.98			2.04			3.77		

(yellow) = Exceeds Threshold Effects Concentration (TEC) of MacDonald, et al. (2000)

(red) = Exceeds Probable Effects Concentration (PEC) of MacDonald, et al. (2000)

Appendix C

Core A

Parameter	Units	PEC-Q-06-A	ChR00-07-A		PEC-Q-07-A	ChR00-09-A		PEC-Q-09-A	ChR00-10-A		PEC-Q-10-A	ChR00-11-A		PEC-Q-11-A	ChR00-12-A		PEC-Q-12-A
Latitude	dd mm.mmmm		41 51.9868			41 50.4491			41 50.5133			41 50.4834			41 50.5161		
Longitude	dd mm.mmmm		87 38.0830			87 39.8770			87 40.4396			87 40.2868			87 40.2869		
Water Depth	inches																
Sample Start Depth	inches		0			0			0			0			0		
Sample End Depth	inches		6			6			6			24			36		
Arsenic	mg/kg	0.26	6.8		0.21	10.1		0.31	8.4		0.25	13.8		0.42	9.7		0.29
Cadmium	mg/kg	0.42	13.2		2.64	3.6		0.72	9.5		1.90	34.3		6.86	33.9		6.78
Chromium	mg/kg	0.28	150.0		1.35	77.7		0.70	122.0		1.10	470.0		4.23	327.0		2.95
Copper	mg/kg	0.42	327.0		2.19	188.0		1.26	308.0		2.07	412.0		2.77	362.0		2.43
Cyanide	mg/kg		0.85	B		0.36	B		1.4			3.2			5.3		
Lead	mg/kg	1.41	335.0		2.62	384.0		3.00	422.0		3.30	869.0		6.79	774.0		6.05
Mercury	mg/kg	1.23	0.9		0.87	1.2		1.13	2.0		1.89	2.0		1.89	1.5		1.42
Nickel	mg/kg	0.47	50.6		1.04	33.8		0.70	46.4		0.95	132.0		2.72	104.0		2.14
Phosphorous	mg/kg		11.5	B		17.5			3.7	B		10.0	B		311.0		
Zinc	mg/kg	0.36	992.0		2.16	665.0		1.45	991.0		2.16	1660.0		3.62	1410.0		3.07
2-Methylnaphthalene	ug/kg		<460	U			ND		920	J		1,400	J		<1500	U	
Acenaphthene	ug/kg		190	J		1,800	J		750	J		1,900	J		1,200	J	
Acenaphthylene	ug/kg		<270	U			ND		200	J		890	J		<890	U	
Anthracene	ug/kg		<460	U		4,500	J		950	J		3,700	J		2,000	J	
Benzo(a)anthracene	ug/kg		2,300			7,800			3,200			9,700			5,500		
Benzo(a)pyrene	ug/kg		2,500			6,800			2,500			8,400			5,100		
Benzo(b)fluoranthene	ug/kg		2,700			5,400	J		3,100			11,000			6,200		
Benzo(g,h,i)perylene	ug/kg		1,300			3,700	J		1,800			5,700			2,600	J	
Benzo(k)fluoranthene	ug/kg		2,700			12,000			2,600			9,600			4,500		
Chrysene	ug/kg		3,100			11,000			3,700			12,000			7,400		
Dibenz(a,h)anthracene	ug/kg		680	J			ND		820	J		ND			1,200	J	
Fluoranthene	ug/kg		4,500			27,000			6,900			19,000			14,000		
Fluorene	ug/kg		<240	U			U		840	J		2,700			1,900	J	
Indeno(1,2,3-cd)pyrene	ug/kg		1,700			3,700	J		2,000			4,900			3,200	J	
Naphthalene	ug/kg		<240	U		3,200	J		940	J		1,400	J		<800	U	
Phenanthrene	ug/kg		2,200			22,000			4,800			14,000			9,600		
Pyrene	ug/kg		3,900			25,000			7,000			23,000			11,000		
Total PAHs	ug/kg	1.10	27,770		1.22	133,900		5.87	43,020		1.89	129,290		5.67	75,400		3.31
Total PCBs (Arochlors)	ug/kg	1.64	3,630		5.37	2,800		4.14	4,600		6.80	15,500		22.93	1,170		1.73
Chlordane	ug/kg		<56	U		<57	U		<52	U		<46	U		<37	U	
Dieldrin	ug/kg		<11	U		<120	U		<10	U		<93	U		<7	U	
4,4'-DDD	ug/kg		95			96	J		63			67	J		51		
4-4'-DDE	ug/kg		84			120	J		59			150			91		
4-4'-DDT	ug/kg		<12	U		<120	U		<11	U		<93	U		<8	U	
Endrin	ug/kg		<14	U		<120	U		<13	U		<93	U		<9	U	
Heptachlor Epoxide	ug/kg		19	J		<57	U		<4	U		53			31		
Lindane	ug/kg		<8	U		<57	U		<7	U		<46	U		<5	U	
Aldrin	mg/kg		<4	U		<9	U		<4	U		<7	U		<3	U	
Mirex	mg/kg		<3	U		<6	U		<3	U		<5	U		<2	U	
Toxaphene	mg/kg		<150	U		<310	U		<140	U		<250	U		<100	U	
Octochlorostyrene	mg/kg		<4	U		<8	U		<4	U		<7	U		<3	U	
TOC	mg/kg		58,800			101,000			82,500			105,000			77,200		
% Solids	%		30.2			29.1			32.6			35.8			45.3		
% Moisture	%		69.8			70.9			67.4			64.2			54.7		
Oil & Gease	mg/kg		9,890			25,800			12,800			24,800			24,600		
COD	mg/kg		182,000			312,000			240,000			271,000			237,000		
SUM PEC-Q		7.6			19.7			19.3			22.3			57.9			30.16
PEC-Q		0.76			1.97			1.93			2.23			5.79			3.02
MAX PEC-Q		1.64			5.37			5.87			6.80			22.93			6.78
	= Exceeds																
	= Exceeds																

Appendix C
Core B

Parameter	Units	TEC	PEC	ChR00-01-B		PEC-Q-02-B	ChR00-01-B-FD		PEC-Q-01-B-FD	ChR00-02-B		PEC-Q-02-B	ChR00-03-B		PEC-Q-03-B	ChR00-04-B		PEC-Q-04-B
Latitude				41 55.2413			41 55.2419			41 54.5855			41 54.0837			41 54.0549		
Longitude				87 40.0498			87 40.0511			87 39.4600			87 39.3709			87 38.8139		
Water Depth	inches			69			69			154								
Sample Start Depth	inches			6			6			6			6			6		
Sample End Depth	inches			18			18			18			18			18		
Arsenic	mg/kg	**9.79**	**33.0**	7.0		0.21	9.0		0.27	7.6		0.23	6.6		0.20	6.9		0.21
Cadmium	mg/kg	**0.99**	**5.0**	48.2		9.64	47.9		9.58	39.7		7.94	13.2		2.64	12.5		2.50
Chromium	mg/kg	**43.4**	**111.0**	274.0		2.47	293.0		2.64	259.0		2.33	128.0		1.15	116.0		1.05
Copper	mg/kg	**31.6**	**149.0**	334.0		2.24	368.0		2.47	376.0		2.52	252.0		1.69	263.0		1.77
Cyanide	mg/kg			18.4			14.9						1.2			2.1		
Lead	mg/kg	**35.8**	**128.0**	660.0		5.16	765.0		5.98	393.0		3.07	241.0		1.88	247.0		1.93
Mercury	mg/kg	**0.18**	**1.1**	2.6		2.45	3.1		2.92	1.4		1.32	1.0		0.92	1.3		1.23
Nickel	mg/kg	**22.7**	**49.0**	177.0		3.61	201.0		4.10	140.0		2.86	52.2		1.07	46.7		0.95
Phosphorous	mg/kg			116.0			77.9			1,250.0			9.1	B		<5.9	U	
Zinc	mg/kg	**121**	**459.0**	1,090.0		2.37	1,200.0		2.61	1,280.0		2.79	739.0		1.61	833.0		1.81
2-Methylnaphthalene	ug/kg			1,300			1,300			<870			<380	U		<430	U	
Acenaphthene	ug/kg			1,500			<150	U		290	J		410	J		<270	U	
Acenaphthylene	ug/kg			610	J		650			<870			<220	U		<250	U	
Anthracene	ug/kg			3,900			3,900			780	J		610	J		270	J	
Benzo(a)anthracene	ug/kg			11,000			12,000			2,800			2,600			1,700		
Benzo(a)pyrene	ug/kg			8,600			12,000			2,700			2,700			1,700		
Benzo(b)fluoranthene	ug/kg			8,800			8,100			2,300			3,000			2,700		
Benzo(g,h,i)perylene	ug/kg			5,300			5,500			1,700			2,000			1,400		
Benzo(k)fluoranthene	ug/kg			6,200			6,400			3,600			3,000			1,600		
Chrysene	ug/kg			13,000			15,000			4,000			3,800			2,400		
Dibenz(a,h)anthracene	ug/kg			2,800			3,000			840	J		690	J		480	J	
Fluoranthene	ug/kg			24,000			24,000			6,600			5,900			4,000		
Fluorene	ug/kg			2,100			2,200			470	J		460	J		<220	U	
Indeno(1,2,3-cd)pyrene	ug/kg			5,300			5,800			2,200			2,100			1,400		
Naphthalene	ug/kg			670			710			<870			<200	U		<220	U	
Phenanthrene	ug/kg			16,000			18,000			3,700			3,000			1,500		
Pyrene	ug/kg			25,000			28,000			6,400			6,200			3,300		
Total PAHs	ug/kg	**1610**	**22800**	136,080		5.97	146,560		6.43	38,380		1.68	36,470		1.60	22,450		0.98
Total PCBs (Arochlors)	ug/kg	**59.8**	**676.0**	21,800		32.25	19,600		28.99	3,050		4.51	520		0.77	1,510		2.23
Chlordane	ug/kg			<320	U		<290	U		<45			<46	U		<52	U	
Dieldrin	ug/kg			<65	U		<58	U		<9			<9	U		<10	U	
4,4'-DDD	ug/kg			590			590			47			44	J		62		
4-4'-DDE	ug/kg			280			240	J		73			35	J		43	J	
4-4'-DDT	ug/kg			<71	U		<64	U		<10			<10	U		<11	U	
Endrin	ug/kg			<82	U		<74	U		<11			<12	U		<13	U	
Heptachlor Epoxide	ug/kg			210			190			15	J		<4	U		<4	U	
Lindane	ug/kg			<44	U		<40	U		<6			<6	U		<7	U	
Aldrin	ug/kg			<25	U		<22	U		<3	U		<4	U		<4	U	
Mirex	ug/kg			<18	U		<16	U		<2	U		<3	U		<3	U	
Toxaphene	ug/kg			<880	U		<790	U		<120	U		<120	U		<140	U	
Octochlorostyrene	ug/kg			<23	U		<21	U		<3	U		<3	U		<4	U	
TOC	mg/kg			75,600			73,800			65,100			49,800			58,200		
% Solids	%			52.0			57.8			37.8			36.8			32.4		
% Moisture	%			48.0			42.2			62.2			63.2			67.6		
Oil & Gease	mg/kg			10,000			9,690			16,000			9,680			6,000		
COD	mg/kg			206,000			153,000			252,000			214,000			221,000		
SUM PEC-Q						66.38			66.00			29.3			13.5			14.7
PEC-Q						6.64			6.60			2.93			1.35			1.47
MAX PEC-Q						32.25			28.99			7.94			2.64			2.50

(yellow) **= Exceeds Threshold Effects Concentration (TEC) of MacDonald, et al. (2000)**

(red) **= Exceeds Probable Effects Concentration (PEC) of MacDonald, et al. (2000)**

Appendix C
Core B

ChR00-05-B		PEC-Q-05-B	ChR00-05-B-FR		PEC-Q-05-B-FR	ChR00-07-B		PEC-Q-07-B	ChR00-09-B		PEC-Q-09B	ChR00-10-B		PEC-Q-10-B	ChR00-11-B		PEC-Q-11-B	ChR00-12-B		PEC-Q-12-B
41 53.8224			41 53.8224			41 51.9868			41 50.4491			41 50.5133			41 50.4834			41 50.5161		
87 38.6744			87 38.6744			87 38.0830			87 39.8770			87 40.4396			87 40.2868			87 40.2869		
6			6			6			6			6			24			36		
18			18			19			18			18			42			82		
8.1		0.25	8.7		0.26	8.3		0.25	7.5		0.23	10.6		0.32	25.6		0.78	27.0		0.82
40.0		8.00	38.4		7.68	22.3		4.46	4.2		0.84	11.1		2.22	33.1		6.62	9.8		1.96
320.0		2.88	317.0		2.86	210.0		1.89	71.5		0.64	130.0		1.17	1010.0		9.10	398.0		3.57
564.0		3.79	568.0		3.81	395.0		2.65	167.0		1.12	278.0		1.87	399.0		2.68	311.0		2.09
5.2			4.3			0.97			0.28	B		1.1			3.5			4.3		
613.0		4.79	617.0		4.82	535.0		4.18	418.0		3.27	501.0		3.91	882.0		6.89	698.0		5.45
1.5		1.42	1.9		1.79	1.3		1.23	4.9		4.62	1.3		1.23	5.4		5.09	7.3		6.89
152.0		3.10	153.0		3.12	82.1		1.68	30.9		0.63	51.8		1.06	113.0		2.31	53.4		1.09
1,920.0			2,920.0			1,080.0			71.7			82.5			81.0			601.0		
1,510.0		3.29	1,540.0		3.36	1,110.0		2.42	601.0		1.31	916.0		2.00	2430.0		5.29	1,510.0		3.29
<1800	U		<380	U		<350			<1800	U		2,000			9,400			20,000		
<1100	U		420	J		580	J		<1200	U		810	J		10,000			12,000		
<1000	U		<220	U		390	J		<1100	U		300	J		3,100	J		3,200		
910	J		760	J		1,500			6,100			1,700			19,000			23,000		
3,800	J		3,600			5,900			2,800	J		1,800			24,000			27,000		
3,900	J		3,200			5,700			2,500	J		<250	U		30,000			18,000		
4,400			3,800			5,200			3,100	J		<330	U		19,000			15,000		
2,200	J		2,400			3,700			1,800	J		2,100			9,800			7,700		
3,900	J		2,500			5,500			4,100	J		<280	U		14,000			7,800		
5,700			4,400			6,900			4,500			5,400			42,000			26,000		
<1500	U		1,000			1,500			<1500	U		<320	U		7,600	J		4,100		
8,800			5,900			9,700			10,000			10,000			48,000			33,000		
<910	U		570	J		850			<940	U		1,000			13,000			16,000		
2,700	J		2,700			4,200			1,700	J		1,700			12,000			8,400		
<920	U		<190	U		360	J		<960	U		1,600			3,800	J		11,000		
5,000			4,000			6,200			6,100			6,800			60,000			63,000		
8,300			8,600			11,000			9,900			12,000			60,000			55,000		
49,610		2.18	43,850		1.92	69,180		3.03	52,600		2.31	47,210		2.07	384,700		16.87	350,200		15.36
3,460		5.12	3,930		5.81	4,050		5.99	5,500		8.14	3,800		5.62	4,800		7.10	260		0.38
<43	U		<46	U		<41	U		<89	U		<46	U		<210	U		<180	U	
<9	U		<9	U		<8	U		<18	U		<9	U		<41	U		<35	U	
43	J		57			71			42	J		49			<44	U		<37	U	
63			78			63			75	J		45	J		<79	U		<67	U	
<9	U		<10	U		<9	U		<19	U		<10	U		<45	U		<38	U	
<11	U		<12	U		<10	U		<23	U		<12	U		<52	U		<44	U	
16	J		19	J		18	J		<7	U		<4	U		<17	U		<14	U	
<6	U		<6	U		<6	U		<12	U		<6	U		<28	U		<24	U	
<21	U		<4	U		<3	U		<7	U		<4	U		<16	U		<13	U	
<63	U		<3	U		<2	U		<5	U		<3	U		<11	U		<10	U	
<420	U		<120	U		<110	U		<240	U		<120	U		<560	U		<470	U	
<43	U		<3	U		<3	U		<6	U		<3	U		<15	U		<12	U	
69,200			69,400			54,900			87,100			103,000			146,000			88,800		
38.9			37.0			40.6			37.7			36.8			41.1			48.1		
61.1			63.0			59.4			62.3			63.2			58.9			51.9		
19,100			17,600			14,300			11,100			9,930			45,100			24,300		
240,000			281,000			260,000			193,000			261,000			375,000			387,000		
		34.8			35.4			27.8			23.1			21.5			62.7			40.90
		3.48			3.54			2.78			2.31			2.15			6.27			4.09
		8.00			7.68			5.99			8.14			5.62			16.87			15.36

Appendix C
Core C

Parameter	Units	TEC	PEC	ChR00-01-C		PEC-Q-01C	ChR00-01-C-FD		PEC-Q-01-C-FD	ChR00-02-C		PEC-Q-02C	ChR00-02-C-FR		PEC-Q-02-C-FR
Latitude				41 55.2413			41 55.2419			41 54.5855			41 54.5855		
Longitude				87 40.0498			87 40.0511			87 39.4600			87 39.4600		
Water Depth	inches			69			69			154					
Sample Start Depth	inches			18			18			18			18		
Sample End Depth	inches			54			54			54			54		
Arsenic	mg/kg	**9.79**	**33.0**	12.6		0.38	13.2		0.40	8.6		0.26	9.6		0.29
Cadmium	mg/kg	**0.99**	**5.0**	60.4		12.08	64.3		12.86	56.9		11.38	62.5		12.50
Chromium	mg/kg	**43.4**	**111.0**	534.0		4.81	583.0		5.25	431.0		3.88	498.0		4.49
Copper	mg/kg	**31.6**	**149.0**	506.0		3.40	533.0		3.58	523.0		3.51	553.0		3.71
Cyanide	mg/kg			5.6			9.5			6.2			9.0		
Lead	mg/kg	**35.8**	**128.0**	778.0		6.08	796.0		6.22	798.0		6.23	957.0		7.48
Mercury	mg/kg	**0.18**	**1.1**	3.4		3.21	3.8		3.58	2.3		2.17	1.9		1.79
Nickel	mg/kg	**22.7**	**49.0**	174.0		3.55	162.0		3.31	184.0		3.76	216.0		4.41
Phosphorous	mg/kg			13.3			74.4			10.5	B		1,990.0		
Zinc	mg/kg	**121**	**459.0**	2,010.0		4.38	2,040.0		4.44	1,760.0		3.83	1,960.0		4.27
2-Methylnaphthalene	ug/kg			<1300	U		<1300	U		<1700	U		<350		
Acenaphthene	ug/kg			1,200	J		1,300	J		<1100	U		340	J	
Acenaphthylene	ug/kg			<750			410	J		<1000	U		<210		
Anthracene	ug/kg			2,200	J		2,100	J		1,300	J		620	J	
Benzo(a)anthracene	ug/kg			9,300			9,300			5,100			2,800		
Benzo(a)pyrene	ug/kg			7,900			8,400			5,200			2,200		
Benzo(b)fluoranthene	ug/kg			9,200			7,900			5,800			2,900		
Benzo(g,h,i)perylene	ug/kg			4,700			5,000			2,900			1,700		
Benzo(k)fluoranthene	ug/kg			6,600			8,400			5,400			1,500		
Chrysene	ug/kg			12,000			11,000			7,600			3,200		
Dibenz(a,h)anthracene	ug/kg			2,000	J		2,000	J		<1500	U		600	J	
Fluoranthene	ug/kg			20,000			17,000			13,000			4,900		
Fluorene	ug/kg			1,900	J		2,000	J		<890	U		420	J	
Indeno(1,2,3-cd)pyrene	ug/kg			4,800			5,100			3,200	J		2,000		
Naphthalene	ug/kg			710	J		670	J		<900	U		180	J	
Phenanthrene	ug/kg			13,000			11,000			7,800			3,200		
Pyrene	ug/kg			18,000			19,000			11,000			6,100		
Total PAHs	ug/kg	**1610**	**22800**	113,510		4.98	110,580		4.85	68,300		3.00	32,660		1.43
Total PCBs (Arochlors)	ug/kg	**59.8**	**676.0**	76,000		112.43	87,600		129.59	13,900		20.56	12,500		18.49
Chlordane	ug/kg			<310	U		<330	U		<210	U		<220	U	
Dieldrin	ug/kg			<61	U		<65	U		<42	U		<43	U	
4,4'-DDD	ug/kg			290	J		360			150	J		160	J	
4-4'-DDE	ug/kg			360			400			200	J		190	J	
4-4'-DDT	ug/kg			<67	U		<71	U		<46	U		<47	U	
Endrin	ug/kg			<78	U		<82	U		<54	U		<55	U	
Heptachlor Epoxide	ug/kg			660			780			88	J		83	J	
Lindane	ug/kg			<42	U		<44	U		<29	U		<29	U	
Aldrin	ug/kg			<24	U		<25	U		<16	U		<17	U	
Mirex	ug/kg			<17	U		<18	U		<12	U		<12	U	
Toxaphene	ug/kg			<830	U		<880	U		<570	U		<580	U	
Octochlorostyrene	ug/kg			<22	U		<23	U		<15	U		<15	U	
TOC	mg/kg			93,400			98,000			83,000			86,400		

Appendix C
Core C

Parameter	Units	TEC	PEC	ChR00-01-C		PEC-Q-01C	ChR00-01-C-FD		PEC-Q-01-C-FD	ChR00-02-C		PEC-Q-02C	ChR00-02-C-FR		PEC-Q-02-C-FR
% Solids	%			54.6			51.9			40.0			39.1		
% Moisture	%			45.4			48.1			60.0			60.9		
Oil & Gease	mg/kg			13,400			21,600			15,100			20,600		
COD	mg/kg			277,000			100,000			562,000			367,000		
SUM PEC-Q						155.3			174.1			58.6			58.9
PEC-Q						15.53			17.41			5.86			5.89
MAX PEC-Q						112.43			129.59			20.56			18.49

(yellow)	**= Exceeds Threshold Effects Concentration (TEC) of MacDonald, et al. (2000)**
(red)	**= Exceeds Probable Effects Concentration (PEC) of MacDonald, et al. (2000)**

Appendix C

Core C

ChR00-03-C		PEC-Q-03-C	ChR00-04-C		PEC-Q-04-C	ChR00-05-C		PEC-Q-05-C	ChR00-05-C-FR		PEC-Q-05-C-FR	ChR00-09-C		PEC-Q-09-C	ChR00-10-C		PEC-Q-10-C
41 54.0837			41 54.0549			41 53.8224			41 53.8224			41 50.4491			41 50.5133		
87 39.3709			87 38.8139			87 38.6744			87 38.6744			87 39.8770			87 40.4396		
18			18			18			18			18			18		
54			54			54			54			54			54		
9.2		0.28	8.0		0.24	11.2		0.34	9.0		0.27	24.8		0.75	9.2		0.28
78.5		15.70	46.2		9.24	84.0		16.80	78.8		15.76	21.6		4.32	22.6		4.52
625.0		5.63	334.0		3.01	530.0		4.77	455.0		4.10	508.0		4.58	217.0		1.95
480.0		3.22	461.0		3.09	475.0		3.19	369.0		2.48	405.0		2.72	335.0		2.25
11.4			12.3			5.9			5.6			9.8			1.3		
722.0		5.64	558.0		4.36	721.0		5.63	539.0		4.21	2080.0		16.25	639.0		4.99
1.9		1.79	1.4		1.32	1.9		1.79	2.2		2.08	6.9		6.51	1.4		1.32
148.0		3.02	136.0		2.78	152.0		3.10	120.0		2.45	153.0		3.12	99.9		2.04
9.4	B		7.5	B		52.2			280.0			46.0			14.3		
1,780.0		3.88	1,460.0		3.18	1,800.0		3.92	1,550.0		3.38	3210.0		6.99	1,160.0		2.53
1,600			680	J		2,500	J		3,600			9,700			<1700	U	
1,600			410	J		1,700	J		2,100	J		2,200	J		1,900	J	
290	J		<220	U		<780	U		810	J		<1900	U		<970	U	
2,000			710	J		2,500	J		3,100	J		3,300			2,700	J	
4,200			3,000			4,700			7,600			8,200			6,000		
3,600			2,800			4,400			7,300			8,700			6,100		
3,100			3,200			3,300			6,400			5,900	J		6,100		
2,700			2,700			2,100	J		2,900	J		5,800	J		3,600	J	
3,400			2,700			4,300			5,100			14,000			7,700		
6,000			4,700			5,600			9,000			13,000			8,500		
1,100			<320	U		<1100	U		1,100	J		<2800	U		<1400	U	
8,900			5,700			9,200			11,000			22,000			16,000		
1,400			560	J		1,600	J		2,100	J		3,900	J		2,400	J	
2,800			2,800			2,600	J		3,100	J		5,500	J		3,600	J	
340	J		<200	U		<700	U		<690	U		<1700	U		1,000	J	
7,100			3,500			8,700			11,000			20,000			13,000		
12,000			7,900			9,300			12,000			23,000			17,000		
62,130		2.73	41,360		1.81	62,500		2.74	88,210		3.87	145,200		6.37	95,600		4.19
10,800		15.98	3,710		5.49	21,600		31.95	26,000		38.46	2,250		3.33	6,100		9.02
<39	U		<46	U		<160	U		<160	U		<81	U		<40		
<8	U		<9	U		<32	U		<32	U		<16	U		<8		
110			50			190			200			96			49		
150			48			200			210			330			59		
<9	U		<10	U		<35	U		<35	U		<18	U		<9		
<10	U		<12	U		<41	U		<41	U		<20	U		<10		
79			23	J		130			130			220	U		19	J	
<5	U		<6	U		<22	U		<22	U		<11	U		<5		
<3	U		<4	U		<12	U		<12	U		<6	U		<3	U	
<2	U		<3	U		<9	U		<9	U		<4	U		<2	U	
<120	U		<130	U		<440	U		<440	U		<220	U		<110	U	
<3	U		<3	U		<11	U		<11	U		<6	U		<3	U	
79,000			60,900			77,900			63,600			139,000			74,200		

Appendix C

Core C

ChR00-03-C		PEC-Q-03-C	ChR00-04-C		PEC-Q-04-C	ChR00-05-C		PEC-Q-05-C	ChR00-05-C-FR		PEC-Q-05-C-FR	ChR00-09-C		PEC-Q-09-C	ChR00-10-C		PEC-Q-10-C
42.6			36.0			52.4			52.4			42.0			42.2		
57.4			64.0			47.6			47.6			58.0			57.8		
17,500			18,900			16,000			16,600			26,600			22,600		
152,000			286,000			185,000			240,000			266,000			263,000		
		57.9			34.5			74.2			77.1			54.94			33.10
		5.79			3.45			7.42			7.71			5.49			3.31
		15.98			9.24			31.95			38.46			16.25			9.02

Appendix C
Core D

Parameter	Units	TEC	PEC	ChR00-01-D		PEC-Q-01-D	ChR00-01-D-FD		PEC-Q-01-D-FD	ChR00-02-D		PEC-Q-02-D
Latitude				41 55.2413			41 55.2419			41 54.5855		
Longitude				87 40.0498			87 40.0511			87 39.4600		
Water Depth	inches			69			69			154		
Sample Start Depth	inches			54			54			54		
Sample End Depth	inches			63			65			90		
Arsenic	mg/kg	**9.79**	**33.0**	13.5		0.41	16.5		0.50	10.9		0.33
Cadmium	mg/kg	**0.99**	**5.0**	52.2		10.44	60.2		12.04	99.5		19.90
Chromium	mg/kg	**43.4**	**111.0**	484.0		4.36	621.0		5.59	700.0		6.31
Copper	mg/kg	**31.6**	**149.0**	501.0		3.36	571.0		3.83	716.0		4.81
Cyanide	mg/kg						12.5			26.4		
Lead	mg/kg	**35.8**	**128.0**	753.0		5.88	757.0		5.91	1,150.0		8.98
Mercury	mg/kg	**0.18**	**1.1**	3.8		3.58	3.1		2.92	2.5		2.36
Nickel	mg/kg	**22.7**	**49.0**	170.0		3.47	150.0		3.06	248.0		5.06
Phosphorous	mg/kg			4.8			<9.9	U		229.0		
Zinc	mg/kg	**121**	**459.0**	2,160.0		4.71	2,230.0		4.86	2,510.0		5.47
2-Methylnaphthalene	ug/kg			<1400	U		590	J		<1700	U	
Acenaphthene	ug/kg			990	J		510	J		680	J	
Acenaphthylene	ug/kg			<840	U		170	J		<990	U	
Anthracene	ug/kg			1,800	J		910			1,300	J	
Benzo(a)anthracene	ug/kg			8,100			4,600			5,100		
Benzo(a)pyrene	ug/kg			7,000			3,700			4,700		
Benzo(b)fluoranthene	ug/kg			7,000			5,200			5,000		
Benzo(g,h,i)perylene	ug/kg			4,100			2,500			2,300	J	
Benzo(k)fluoranthene	ug/kg			9,100			2,800			5,300		
Chrysene	ug/kg			10,000			4,900			7,000		
Dibenz(a,h)anthracene	ug/kg			2,000	J		980			<4000	U	
Fluoranthene	ug/kg			17,000			8,100			11,000		
Fluorene	ug/kg			1,800	J		980			<4000	U	
Indeno(1,2,3-cd)pyrene	ug/kg			4,900			2,500			2,700	J	
Naphthalene	ug/kg			820	J		440	J		<890		
Phenanthrene	ug/kg			12,000			5,900			7,300		
Pyrene	ug/kg			16,000			8,400			9,600		
Total PAHs	ug/kg	**1610**	**22800**	102,610		4.50	53,180		2.33	61,980		2.72
Total PCBs (Arochlors)	ug/kg	**59.8**	**676.0**	21,800		32.25	27,000		39.94	29,500		43.64
Chlordane	ug/kg			<170	U		<170	U		<210	U	
Dieldrin	ug/kg			<35	U		<35	U		<41	U	
4,4'-DDD	ug/kg			94	J		110	J		180	J	
4-4'-DDE	ug/kg			180			200			230		
4-4'-DDT	ug/kg			<38	U		<38	U		<45	U	
Endrin	ug/kg			<44	U		<44	U		<52	U	
Heptachlor Epoxide	ug/kg			190			230			130		
Lindane	ug/kg			<23	U		<24	U		<28	U	
Aldrin	ug/kg			<13	U		<13	U		<16	U	
Mirex	ug/kg			<9	U		<10	U		<11	U	
Toxaphene	ug/kg			<470	U		<470	U		<560	U	
Octochlorostyrene	ug/kg			<12	U		<12	U		<15	U	
TOC	mg/kg			94,600			67,200			100,000		
% Solids	%			48.6			48.4			40.8		
% Moisture	%			51.4			51.6			59.2		
Oil & Grease	mg/kg			16,100			15,300			25,200		
COD	mg/kg			293,000			287,000			310,000		
SUM PEC-Q						73.0			81.0			99.6
PEC-Q						7.30			8.10			9.96
MAX PEC-Q						32.25			39.94			43.64

Parameter	ChR00-02-D-FR		PEC-Q-02-D-FR	ChR00-03-D		PEC-Q-03-D	ChR00-04-D		PEC-Q-04-D	ChR00-09-D		PEC-Q-09-D	ChR00-10-D		PEC-Q-10-D
Latitude	41 54.5855			41 54.0837			41 54.0549			41 50.4491			41 50.5133		
Longitude	87 39.4600			87 39.3709			87 38.8139			87 39.8770			87 40.4396		
Water Depth															
Sample Start Depth	54			54			54			54			54		
Sample End Depth	90			65			64			72			77		
Arsenic	10.7		0.32	39.8		1.21	11.0		0.33	30.0		0.91	11.6		0.35
Cadmium	96.5		19.30	140.0		28.00	90.6		18.12	27.1		5.42	34.2		6.84
Chromium	693.0		6.24	1,110.0		10.00	636.0		5.73	1700.0		15.32	343.0		3.09
Copper	707.0		4.74	666.0		4.47	681.0		4.57	499.0		3.35	347.0		2.33
Cyanide	28.1			4.7			14.3			0.57			1.2		
Lead	1,140.0		8.91	908.0		7.09	1,170.0		9.14	1820.0		14.22	1,840.0		14.38
Mercury	2.5		2.36	2.8		2.64	2.0		1.89	6.4		6.04	2.6		2.45
Nickel	348.0		7.10	162.0		3.31	208.0		4.24	267.0		5.45	118.0		2.41
Phosphorous	122.0			9.0	B		5.9	B		69.9			17.3		
Zinc	2,420.0		5.27	2,100.0		4.58	2,180.0		4.75	5470.0		11.92	1,500.0		3.27
2-Methylnaphthalene	<1700			14,000			1,300			14,000			48,000		
Acenaphthene	680	J		9,100			680	J		2,500	J		41,000		
Acenaphthylene	<990			1,100			<200	U		<2100	U		1,800	J	
Anthracene	1,600	J		8,300			870			4,300	J		140,000		
Benzo(a)anthracene	5,300			14,000			3,700			9,700			26,000		
Benzo(a)pyrene	5,100			13,000			3,400			9,500			19,000		
Benzo(b)fluoranthene	6,300			11,000			3,000			6,800	J		17,000		
Benzo(g,h,i)perylene	2,900	J		6,700			2,600			6,000	J		8,800		
Benzo(k)fluoranthene	4,800			8,100			3,800			14,000			19,000		
Chrysene	7,500			14,000			6,400			15,000			26,000		
Dibenz(a,h)anthracene	<1400			2,300	J		1,300			<3000	U		5,100	J	
Fluoranthene	14,000			26,000			8,100			27,000			67,000		
Fluorene	1,200	J		8,400			820	J		5,200	J		45,000		
Indeno(1,2,3-cd)pyrene	3,400	J		6,000			3,000			6,000	J		9,300		
Naphthalene	<880			2,600	J		310	J		1,800	J		33,000		
Phenanthrene	8,700			36,000			4,900			25,000			140,000		
Pyrene	11,000			36,000			11,000			28,000			75,000		
Total PAHs	72,480		3.18	216,600		9.50	55,180		2.42	174,800		7.67	721,000		31.62
Total PCBs (Arochlors)	25,000		36.98	54,300		80.33	11,500		17.01	14,800		21.89	16,000		23.67
Chlordane	<210	U		<340	U		<210	U		<220	U		<170	U	
Dieldrin	<41	U		<69	U		<42	U		<44	U		<33	U	
4,4'-DDD	180	J		830			150	J		<46	U		140	J	
4-4'-DDE	230			490			200	J		500			190		
4-4'-DDT	<45	U		<75	U		<46	U		<47	U		<36	U	
Endrin	<52	U		<87	U		<53	U		<55	U		<42	U	
Heptachlor Epoxide	130			530			89	J		<18	U		72	J	
Lindane	<28	U		<46	U		<29	U		<29	U		<23	U	
Aldrin	<16	U		<26	U		<100	U		<17	U		<82	U	
Mirex	<11	U		<19	U		<310	U		<12	U		<2550	U	
Toxaphene	<560	U		<930	U		<2100	U		<590	U		<1600	U	
Octochlorostyrene	<15	U		<24	U		<210	U		<15	U		<170	U	
TOC	83,800			93,900			78,100			188,000			105,000		
% Solids	41.3			48.5			40.0			38.6			50.0		
% Moisture	58.7			51.5			60.0			61.4			50.0		
Oil & Grease	31,300			19,400			29,900			6,900			24,800		
COD	339,000			222,000			299,000			682,000			206,000		
SUM PEC-Q			94.4			151.1			68.2			92.18			90.41
PEC-Q			9.44			15.11			6.82			9.22			9.04
MAX PEC-Q			36.98			80.33			4.24			21.89			31.62

= Exceeds Threshold Effects Concentration (TEC) of MacDonald, et al. (2000)

= Exceeds Probable Effects Concentration (PEC) of MacDonald, et al. (2000)

Appendix D

Whole Sediment Toxicity Testing

Sample id	Latitude	Longitude	C. tentans Survival Replicate A	C. tentans Survival Replicate B	C. tentans Survival Replicate C	C. tentans Survival Replicate D	C. tentans Survival Replicate E	C. tentans Survival Replicate F	C. tentans Survival Replicate G	C. tentans Survival Replicate H	H. azteca Mean Survival	H. azteca Std Dev Survival
ChR00-02-P	41 54.5779	87 39.4452	90	80	100	100	100	90	70	80	89	10.53
ChR00-05-P	41 53.8222	87 38.6629	90	80	90	90	100	100	80	70	88	9.68
ChR00-05FD-P	41 53.8280	87 38.6631	90	100	100	100	100	90	70	90	93	9.68
ChR00-06-P	41 53.2838	87 36.9466	100	------	80	90	------	90	90	90	90	5.77
ChR00-07-P	41 52.0039	87 38.0856	80	100	90	60	90	------	100	100	89	13.55
ChR00-08-P	41 50.6825	87 39.8022	90	90	90	90	100	90	100	100	94	4.84
WBC Control			*100*	*60*	*100*	*60*	*100*	*100*	*80*	*80*	*90*	*16.67*

Sample id	Latitude	Longitude	H. azteca Survival Replicate A	H. azteca Survival Replicate B	H. azteca Survival Replicate C	H. azteca Survival Replicate D	H. azteca Survival Replicate E	H. azteca Survival Replicate F	H. azteca Survival Replicate G	H. azteca Survival Replicate H	C. tentans Mean Survival	C. tentans Std Dev Survival
ChR00-02-P	41 54.5779	87 39.4452	30	60	80	90	80	90	70	100	75	*20.62*
ChR00-05-P	41 53.8222	87 38.6629	100	100	100	60	80	90	100	------	93	*14.18*
ChR00-05FD-P	41 53.8280	87 38.6631	80	70	100	100	70	90	90	100	88	*11.99*
ChR00-06-P	41 53.2838	87 36.9466	100	50	100	------	90	90	100	100	93	*16.94*
ChR00-07-P	41 52.0039	87 38.0856	100	100	100	100	100	100	90	100	99	*3.31*
ChR00-08-P	41 50.6825	87 39.8022	100	100	90	100	90	100	100	------	97	*4.52*
WBC Control			*100*	*100*	90	*100*	*90*	100	*100*	------	*93*	*4.75*

Sample id	Latitude	Longitude	H. azteca Growth Replicate A	H. azteca Growth Replicate B	H. azteca Growth Replicate C	H. azteca Growth Replicate D	H. azteca Growth Replicate E	H. azteca Growth Replicate F	H. azteca Growth Replicate G	H. azteca Growth Replicate H	C. tentans Mean Weight	C. tentans Std Dev Weight
ChR00-02-P	41 54.5779	87 39.4452	0.0005	0.0006	0.001	0.0006	0.0009	0.0005	0.0008	0.001	0.0008	*0.000201*
ChR00-05-P	41 53.8222	87 38.6629	0.0009	0.0008	0.0009	0.0011	0.0008	0.001	0.0009	0.0009	0.0009	*0.000093*
ChR00-05FD-P	41 53.8280	87 38.6631	0.0011	0.0009	0.0009	0.0009	0.001	0.0009	0.001	0.0009	0.001	*0.000073*
ChR00-06-P	41 53.2838	87 36.9466	0.001	0.001	0.0011	0.001	0.0009	0.0011	0.0011	0.0012	0.001	*0.000088*
ChR00-07-P	41 52.0039	87 38.0856	0.0007	0.001	0.001	0.0009	0.001	0.0011	0.0008	0.0009	0.0009	*0.000120*
ChR00-08-P	41 50.6825	87 39.8022	0.0009	0.0011	0.001	0.0009	0.0011	0.001	0.0011	0.001	0.001	*0.000078*
WBC Control			*0.0008*	*0.0011*	*0.0012*	*0.0009*	*0.0011*	*0.0009*	*0.001*	*0.0012*	*0.001*	*0.000139*

*** Highlight**: **Indicates significant toxicity compared to the mean**

* *Italics*: **Indicates Control Sample**

Appendix D

2002 Toxicity Data

Sample id	Latitude	Longitude	No. of Original to Start	No. Surviving	Mean % Survival	Standard Deviation	Coefficient of Variation
ChR00-02-P	41 54.5752	87 39.4486	80	14	17.5	17.525	100.146
ChR00-02FD-P	41 54.5752	87 39.4486	80	61	76.25	16.85	22.099
ChR00-05-P	41 53.8167	87 38.6651	80	68	85	15.119	17.787
ChR00-06-P	41 53.2870	87 36.9541	80	71	88.75	9.91	11.167
ChR00-07-P	41 52.0035	87 38.0847	80	0	0	0	0
ChR00-08-P	41 50.6302	87 39.8984	80	21	26.25	29.246	111.415
Control			*80*	*80*	*100*	*0*	*0*

Sample id	Total Org's Wght. (g)	Avg. Indiv. Wght based on # of survivors (mg)	Standard Deviation of Avg. Wght based on # of survivors	Coefficient of Variation based on survivors	Avg. Indiv. Wght based on # exposed (mg)	Standard Deviation of Avg. Wght based on # exposed	Coefficient of Variation based on exposed
ChR00-02-P	0.00012	0.051	0.053	105.268	0.012	0.012	99.744
ChR00-02FD-P	0.0005	0.067	0.021	31.023	0.05	0.016	32.355
ChR00-05-P	0.00071	0.085	0.02	23.656	0.71	0.017	23.672
ChR00-06-P	0.00063	0.072	0.014	19.411	0.063	0.011	17.614
ChR00-07-P	0	ND	ND	ND	ND	ND	ND
ChR00-08-P	0.00019	0.068	0.052	76.198	0.019	0.016	80.943
Control	*0.00114*	*0.114*	*0.037*	*32.186*	*0.114*	*0.037*	*32.186*

* **Highlight**: **Indicates significant toxicity compared to the mean**
* *Italics*: **Indicates Control Sample**

Appendix E
Dioxins/Furans TEQs

RESULTS FROM CHICAGO RIVER SAMPLING - OCTOBER 2000													
	TEF	Blank	ChR00-02-A	ChR00-02-B	ChR00-02-C	ChR00-02-D	ChR00-02-C-FD	ChR00-02-D-FR	ChR00-07-A	ChR00-07-B	ChR00-05-A	ChR00-05-B	ChR00-05-C
Analytes (Units ppt)	**Multiplier**												
Latitude (dd.ddddd)			41 54.5855	41 54.5855	41 54.5855	41 54.5855	41 54.5855	41 54.5855	41 51.9868	41 51.9868	41 53.8224	41 53.8224	41 53.8224
Longitude (dd.ddddd)			87 39.4600	87 39.4600	87 39.4600	87 39.4600	87 39.4600	87 39.4600	87 38.0830	87 38.0830	87 38.6744	87 38.6744	87 38.6744
2378-TCDD	1	0.2	9.2	45	94.0	38.0	79	50	11	27	7.2	83	27
12378-PeCDD	0.5	0.35	12	36	95.0	76.0	81	77	18.0	33	12	67	49
123478-HxCDD	0.1	0.21	16	20	38.0	5.0	43	43	15.0	23	14	27.0	26
123678-HxCDD	0.1	0.19	49.0	93	220.0	300.0	240	330	66.0	99	49	140	220
123789-HxCDD	0.1	0.18	45	74	210	190	180	200	49.0	86	37	140	140
1234678-HpCDD	0.01	0.18	1100	2200	4200	5500	4500	5700	1400	1800	1000	2300	3000
OCDD	0.001	0.63	9700	25000	41000	64000	45000	56000	14000	15000	7700	20000	29000
2378-TCDF	0.1	0.18	11	15	37	56	44	60	28	56	10	28	45
12378-PeCDF	0.05	0.23	7.9	11	27	31	30	34	34	83	9.3	22	46
23478-PeCDF	0.5	0.23	12	16	34	45	42	48	22	36	14	25.0	65.0
123478-HxCDF	0.1	0.11	38	47	95	130	110	150	66.0	140	30	65	230
123678-HxCDF	0.1	0.1	18	26.0	54.0	60.0	55.0	65.0	32	56	21	38	88
234678-HxCDF	0.1	0.12	13.0	18.0	38.0	39.0	42.0	44.0	20.0	30	18	30	50.0
123789-HxCDF	0.1	0.12	1.3	1.7	2.8	3.0	2.9	3.0	4.6	20	1.4	2.1	2.9
1234678-HpCDF	0.01	0.1	330	480	950	1200	1200	1400	470	590	320	610	1400
1234789-HpCDF	0.01	0.13	21.0	34	63	67.0	76	73	46	80	21	42	67
OCDF	0.001	0.29	810	1300	2400	2700	2800	3100	1200	1400	680	1800	2800
TOTAL TCDD		0.22	120	220	490	280	480	330	170	220	92	390	200
TOTAL PeCDD		0.35	110.0	310	690	530	630	530	140	240	96	540	350
TOTAL HxCDD		0.29	420	850	2300	3100	2400	2900	560	900	410	1400	1900
TOTAL HpCDD		0.18	2100	4300	8900	13000	9600	12000	3000	3600	1900	4700	6500
TOTAL TCDF		0.18	230	320	620	980	770	1000	400	670	260	480	1100
TOTAL PeCDF		0.23	250	380	710	910	890	1000	400	670	280	650	1300
TOTAL HxCDF		0.12	400	620	1300	1500	1400	1700	600	940	410	910	1900
TOTAL HpCDF		0.13	870	1400	2800	3500	3200	4000	1300	1600	820	1800	3300
Total TEQs (ppt)			65.7	154.5	324.9	312.7	319.3	334.5	95.1	157.8	60.5	228.4	243.0
TOC (mg/kg)			64,700	65,100	83,000	100,000	86,400	83,800	58,800	59,400	58,300	69,200	77,900
TOC NormalizedTEQs (ug/kg OC)			1.0	2.4	3.9	3.1	3.7	4.0	1.6	2.7	1.0	3.3	3.1
Total Dioxin Homologs			12,450	30,680	53,380	80,910	58,110	71,760	17,870	19,960	10,198	27,030	37,950
Total Furan Homologs			2,560	4,020	7,830	9,590	9,060	10,800	3,900	5,280	2,450	5,640	10,400

[yellow] = Indicates exceedence of NYSDEC TEQ Wildlife Criteria (0.2 ug/kg OC) or
exceedence of the NYSDEC qualitative "background" contamination levels (>1,000 ppt for dioxins and >100 ppt for furans) for total homologs.

[red] = Indicates exceedence of NYSDEC TEQ Human Health Criteria (10.0 ug/kg OC) or
exceedence of the NYSDEC qualitative "severe" contamination levels (>25,000 ppt for dioxins and >2,500 ppt for furans) for total homologs.